

BY WATERWAYS , TO GOTHAM ,

Lewis R. Freeman



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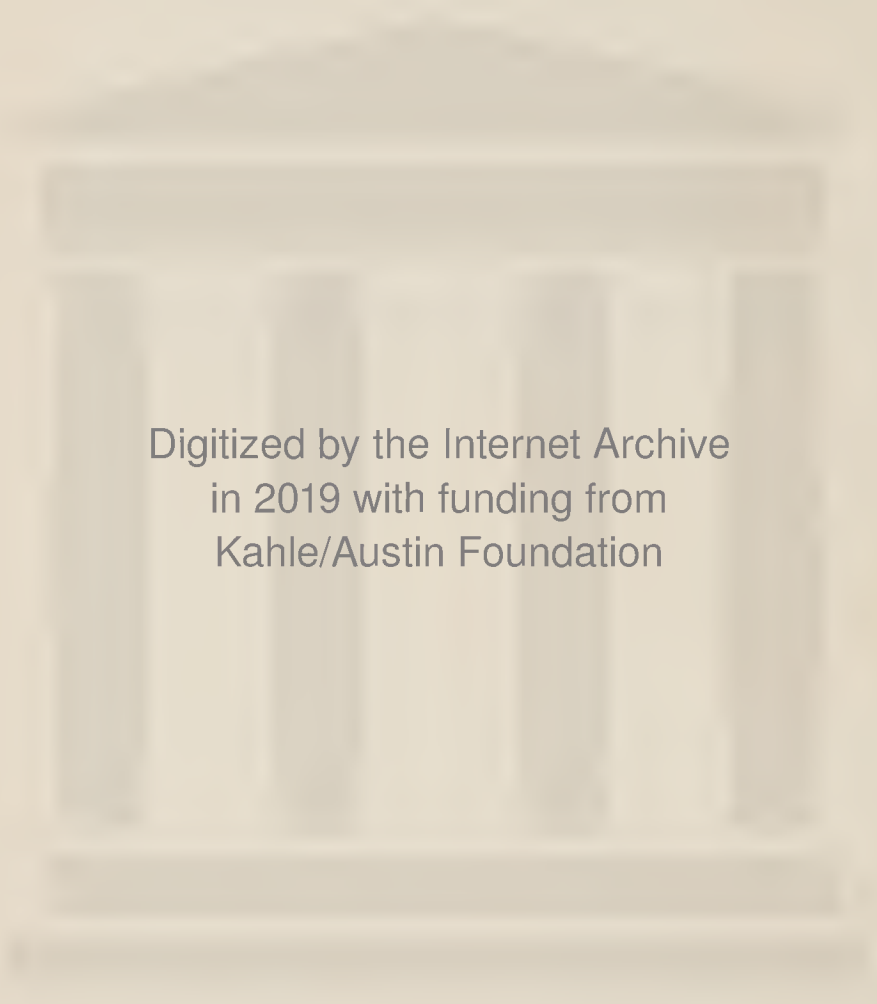


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BY WATERWAYS TO GOTHAM



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THROUGH THE OLD GATE AT FORT MACKINAC

BY WATERWAYS TO GOTHAM

THE ACCOUNT OF A TWO THOUSAND MILE VOYAGE
BY SKIFF AND OUTBOARD MOTOR FROM MIL-
WAUKEE TO NEW YORK, THROUGH THE GREAT
LAKES, TRENT CANAL, ST. LAWRENCE,
RICHELIEU, CHAMPLAIN AND HUDSON

BY

LEWIS R. FREEMAN

Author of "DOWN THE COLUMBIA," "DOWN THE
YELLOWSTONE," "THE COLORADO RIVER," ETC.



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BY WATERWAYS TO GOTHAM

CHAPTER I

THE CRUISE AND THE CRAFT

What I fondly pictured in my mind as a "quiet-water" voyage doubtless had its inception in the natural reaction from the several seasons of rough-water boating I had been putting in on the Columbia, Yellowstone and Colorado. Running rapids by way of summer pastime was all right for a while, I told myself, but to keep an edge on zest one should vary it every few seasons with a white-flannels, holystoned-decks, polished-brass sort of a cruise, where wet clothes, sodden blankets and soggy grub would be but a memory calculated to act as a sauce for viands the best the market afforded, cooked in a white-enameled galley and served by a soft-footed steward in a fan-cooled cabin. There should be short, smooth runs between quiet harbors thickly fringed with broad-verandaed summer hotels. The hardest morning's work should be dangling a fish-line over the stern, the afternoon's most strenuous effort the run ashore for five o'clock tea.

Setting out to arrange the practical details of just such an idyllic summer pleasance among the Islands of the Blest, I finished by pushing off in an eighteen-foot skiff to voyage from Milwaukee to New York,

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a jaunt on which I was destined to find more rough work and almost as much rough water as had fallen to my lot in running the rapids of the Grand Canyon of the Colorado the previous year.

Negotiations for the charter of a motor-cruiser were as far as I ever advanced with plans for my delectable dreamed-of cruise of *dolce far niente*. This beautiful little craft was not only capable of navigating the Great Lakes, I was assured, but also—with good weather and seamanlike handling—might be equal to the outside run from the mouth of the St. Lawrence to New York. The signing-up of my ideal crew languished from the first, principally because the several friends I had counted upon were quite unable to get away for the six months of more or less careless drifting with winds and current I had held out as the main inducement.

As *dolce far niente* with hired help is a thing unthinkable, prospects for carrying out the ideal plan as originally conceived were at a low ebb when word came that a place was open for me with an expedition being organized in Banff to explore the icefields of the Canadian Rockies during the late summer and fall. As the opportunity was one which might not occur again for years, I decided without hesitation to take advantage of it. That left only a few weeks of June and July in which my long-planned-for “quiet water” voyage could be taken, and that only

by the elimination of the soft-ease and sweet-doing-nothing part of the program, its principal *raison d'être* in the original conception. When even the change to a shorter route and faster schedule failed to bring out any desirable recruits, I gave up the motor-cruiser idea and decided to try to contrive some sort of an outfit in which I could make an attempt at the voyage alone.

For a leisurely voyage the ideal type of one-man outfit would have been a small sloop and a light auxiliary engine. This alluring combination was hard to forego, but I finally decided against it on the grounds that it would be too slow either with or without engine, while a failure on the part of both would leave it practically a derelict. A straight motor boat of ten or twelve knot speed would have given me all the mileage I needed, but would have been quite as helpless as the becalmed sloop in the event of engine trouble. The fact that neither sloop nor motor boat could be beached by one man if driving on a lee shore, or even to take advantage of a favorable camping place, also made me reluctant to take a chance with either of them.

In the end the only outfit that seemed calculated to satisfy all demands, as well as to conform to all limiting considerations, was the simple combination of a round-bottomed skiff and an outboard motor. The best of the late motors of this type would give me all

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the speed I needed without being prohibitively heavy. In case the engine went wrong, there was sail to fall back upon if the wind was fair, with the oars as a last resort whatever happened short of foundering. I hoped also to be able to keep the outfit light enough to make it possible to drag it out of the water unaided, a great convenience at all times, and possibly the means of averting disaster if caught in a storm.

Both boat and motor were ordered before I left California. The engine I decided to pin my faith to was the Elto, the latest product of the pioneer outboard motor designer, Ole Evinrude. I had previously used this light but powerful "twin" in the muddy waters of the Missouri, Mississippi and lower Colorado, where its remarkable showing under all but prohibitive conditions gave me confidence that it would be equal to the most I could ask from it in the clear and (as I supposed) more tranquil waters of the Great Lakes.

The boat chosen was a Rhinelander Special, a type much used by the guides of northern Wisconsin. This was shown by the catalogue to be an open round-bottomed skiff of fine lines. To make it dryer in driving into head seas, I ordered a water-tight compartment built forward, running back six feet from the bow. I figured that this would have the added advantage of affording much greater buoyancy in case of an upset. The water-tight compartments

had proved an invaluable feature of the boats we had used in the Grand Canyon.

Realizing that I was almost totally ignorant of the conditions even along the general route which I contemplated following from Lake Michigan to New York, and not even sure that there was a complete water-way open save by the old Erie Canal, I took advantage of the interval during which my outfit was being assembled for a hasty advance scouting trip. This was a fortunate action in several respects. Not only did it permit me to lay out a more interesting and practicable course before starting, but what I saw also engendered a deep and abiding respect for the Great Lakes as potential breeders of trouble for the unwary navigator. I had still to learn of their might and their menace by practical and not always pleasant experience, but I was at least sufficiently forewarned to take a deal more care about forearming than would otherwise have been the case.

It is not usually well advised to form snap judgments based on first impressions. There may be a few of the great manifestations of Nature,—like the everlasting mountains for instance,—that are more or less the same to-day as they were yesterday, and which, if we avoid reckoning in geological time, may not be altered out of recognition even to-morrow. But this does not apply to things made of water, like oceans and lakes and rivers. The naming of the Pacific is a

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case in point. Because the stormiest of the world's great oceans chanced to be smiling the day its discoverer sailed into it, he called it *Pacifico*, leaving those who have battled its squalls and fogs and typhoons to chuckle or curse over the nomenclatural absurdity ever since.

The acid of first impression etches the plates of the mind with a sharpness peculiarly its own. The mental picture I had carried for a dozen years of the whole Great Lakes system was the result of the fact that my maiden glimpse of Lake Michigan discovered a glassy stretch of windless water underrun with just enough of motion to throw a single flip of wavelet upon a crescent of snowy beach. That mental snapshot, carefully ticketed and filed, was my typical Great Lakes picture; the very one, in fact, which drew me in that direction when the yearning for a quiet-water voyage welled strong within me. I knew in a general way that the Great Lakes were in the cyclone area, and I had read of their being swept at times by terrible blizzards. As these accounts were mostly in Southern California papers, I was inclined to discount them as a part of the regular propaganda for keeping tourists contented in the West. And so I went right on thinking of the Great Lakes, from the heads of Michigan and Superior to the St. Lawrence, as just one silver strand after another bordering long narrow reaches of water that were quite as flat and

blue in real life as upon the maps. And so, as I have said, it was rather fortunate that I scouted a bit in advance of my projected cruise to learn just how and where this somewhat idealized picture was out of focus with the facts.

My first ocular demonstration of the fact that the Great Lakes occasionally had moods other than soft and tender came as a good deal of a shock, especially as it was along toward the end of May when Nature the world over is supposed to be in her gentlest of tempers. There were some signs of atmospheric restlessness in the smoke-thin tracteries of the bobbing boughs of the budding birches as the eastbound Canadian Pacific Limited ran through the fresh spring woods to the west of Superior, but nothing to indicate that just around the next headland a fully developed gale was mustering its forces for what looked like a cool and methodical attempt to tear the surface off the lake and spread it over the Province of Ontario.

The wall of wind that assailed us as the engine drove out onto the cliff-face above the water sent a shiver through the train like the jolt from a rammed snowbank. There was a quick glimpse of a wild welter of tumbling water, with Thunder Cape looming black to the southward like a mountain thrust out of a snowfield, and then the glare of tossing white was dimmed down and quenched as the far-blown spray

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congealed on the lakeward windows. The rest that I saw—solid green water breaking over headlands fifty feet in the sheer; a fishing boat pounding to pieces on the rocks below; a great raft tossed by the waves until it had the seeming of a Magic Carpet fluttering in billowing clouds; wraith-like fisher folk toiling at futile moorings—photographed themselves on my retina between blinks as I clung to an ice-sheathed observation platform that pitched and rolled like the bridge of a destroyer bucking a head sea.

Seas high enough to sweep the decks of a battleship, winds so violent as to keep the great steamers of the grain and iron fleets at their docks, did not, I told myself, give assurance of conditions entirely favorable to the navigators of eighteen-foot open boats. I tried to cheer myself with the reflection that the storm was probably seasonal—the dying kick of winter, so to speak—and as such more or less localized to the largest and most northerly of the lakes. This theory was comforting enough until I bought a paper the next morning. Then I learned that, while the worst casualty of the storm—the loss of the steamer, *Orinoco*, with five of her crew on Montreal Island—had occurred in Lake Superior, there had been much destruction of shipping on all of the Great Lakes. Still less reassuring was the casual reference of a Sault Ste. Marie correspondent to the gale as “the

sort of a minor disturbance we can expect at any time from now on to the middle of July."

And so it proved. Running true to this form sheet, another "minor disturbance" was ruffling up the Lakes by the time my train was skirting the shores of Georgian Bay. What I had mentally pictured as veritable Islands of Enchantment, fairy bowers of sylvan loveliness, had metamorphosed to humps of half barren rocks, with wind-flattened trees waving despairing signals of distress above breaking surges of sullen white. But on the station platform at Perry Sound I heard an old man, with a depreciatory wave of his knotted fingers, declare that this "wa'n't really much of a blow nohow." Six fishing boats and a lighthouse tender missing were evidently rather below than above the average local toll. "Jest wait till next month when the tornaders come borin' in from Mich'gan way," he warned; "then ye'll see the fur fly."

It was the tail of the same disturbance that was lashing up even the closely landlocked waters of the north shore of Lake Ontario when my train fared on eastward from Toronto the following day, but when I stopped at Montreal for my first glimpse of the St. Lawrence it had shifted to a northerly gale whose Arctic breath was tempered by nothing warmer than the frozen tundras of Labrador. What with white

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caps and blown foam, I never did discover just where the famous Lachine Rapids began and ended. Local papers mentioned "a touch of wintriness in the spring air," and let it go at that. And after I had turned west again to get my boat ready the Chicago papers, with similar airy nonchalance, dismissed as "fresh winds from the lake," a north-easter that was driving the combers so hard against the sea-wall that the spray was whirled up to my windows on the fourth story of the Drake.

It was this confounded local casualness about weather that was bad by every standard of comparison of my experience of the Seven Seas that was so disconcerting. On many a previous voyage I had found people over-inclined to exaggerate the menace of their rivers, and especially of their rapids. But here was this hard-bitten Great Lakes populace on both sides of the line saying, in effect, of weather that was at times driving all their shipping behind breakwaters: "Oh this little blow is really nothing at all; just wait till a storm comes along with a kick in it!"

As a matter of fact the fortnight of uninterrupted storms that I had experienced since my first sight of Superior in tantrums was really bad weather; so bad, indeed, that a continuance of it without breaks would have made the open-boat voyage I contemplated quite out of the question. It is true that there broke during the course of my voyage several storms—sum-

mer cyclonic outbursts—that were more violent than anything I had seen from the shores of the Great Lakes in the spring. The worst of these, fortunately, I was able to avoid by scurrying to port, and then taking advantage of spells of fair weather following to make up for lost time. But the chastening effect of this preliminary lifting of the corner of the cover of the Pandora's Box of Great Lakes weather tricks had been unmixedly salutary. I had gained a fairly comprehensive idea of the serious nature of the undertaking upon which I had so lightly embarked, realizing quite clearly that I could never be assured of the success of it until my boat was finally tied up in New York. Seeing plainly where a dozen little things—due to bad luck, bad weather or bad handling—might happen to bring the voyage to a sudden and inglorious ending, I set about getting my outfit ready in a far different spirit than had nothing been revealed to shatter my first fond fancy about the Great Lakes being a connected series of glorified mill-ponds. For this reason several precautionary measures were taken which, omitted, would have left affairs in a serious way at more than one moment of emergency.

I had chosen Milwaukee as my port of departure both because the motor I was using was made there and because it gave me the opportunity to take first-hand advantage of the counsel of Ole Evinrude, the

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motor's designer and manufacturer. A veteran of many years' navigation of Lake Michigan in a motor cruiser, there was a number of points on which Mr. Evinrude's advice promised to be invaluable.

My boat was already on hand when I arrived at Milwaukee early in June. Of cedar, with oak ribs and redwood seats, steel-braced and brass-screwed, it was one of the finest examples of the true boat-builder's art I have ever seen. Beautifully molded to minimize fluid resistance, with a wide flare of bow and a graceful sheer, it was as sweet of line as staunch of construction. In only two particulars did it fail to measure up to and beyond my hopes. One of these was the lack of freeboard aft, the consequence of having been designed primarily for use in the comparatively quiet waters of small lakes; the other, the fact that a water-tight compartment had not been built forward as I had ordered. The bow had been decked over, it is true, but the decking had not been carried to solid bulkhead, so that the enclosed space afforded neither the protection nor the buoyancy of a water-tight hold in the event of swamping or upset. The low freeboard made it inevitable that a lot of green water was going to come tumbling over from both beam and following seas.

It would not have been difficult to complete a water-tight compartment, nor yet to add a cockpit with a high coaming that would have counteracted



THE BOAT WITH SPRAY-HOOD AT SINGLE EXTENSION

the defect of the low gunwales. Both changes, however, would have involved the use of considerable material, thereby further increasing the weight, a point about which I was not a little concerned already. The staunchness of the fine little craft had been gained at some sacrifice of lightness. The moment I lifted the bow I realized that it would be a good stiff piece of work for one man to beach it empty, and that with its engine and a full load there might be places where the task would be an almost impossible one, especially with heavy seas rolling in. Emergency landings were among the things which I knew I would simply have to do the best I could about when the time came, but I was not inclined to increase the odds against success by making the boat any heavier at the outset.

My most serious trouble for the first day or two was that of side-tracking suggestions without hurting the feelings of the very kindly friends by whom they were advanced. Some of them were practical—or rather, they would have been so were I venturing forth in a forty-foot sloop instead of an open skiff. The rest, by and large, included just about everything in the way of safety devices for reducing the risks of sea travel that was discussed in Congress following the sinking of the *Titanic*. Ole Evinrude's common sense and sound knowledge of Great Lakes weather conditions were my main sheet anchors in

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riding out this veritable typhoon of well meant advice and suggestions.

Since it was evident that running into even comparatively light head seas was going to set a deal of loose water flying aft, the matter of a strong and serviceable spray-hood was an important consideration. The one devised and constructed proved highly useful in several respects. It was of heavy waterproofed brown canvas, with brass eyelets along the ends and sides to engage snaps set under the gunwales. Two slender strips of very fine quality spring-steel were the only accessories. With the canvas buttoned down over a coaming on the bow decking and run back to a strip of steel forming an arch between the forward pair of rowlock sockets in either gunwale, a very effective spray-hood was formed. Stretched on back to the second steel strip arched between the after rowlock sockets, the hood was doubled in length, affording that much more cover from spray or rain. Continued on aft and buttoned down around the stern, the canvas formed a complete cover, quite water- and wind-tight to sleep under and useful for protecting the boat and outfit from weather and marauders when left alone. Canvas tie-strings, similar to the reef-points of a sail, made it easy to furl surplus canvas over the intermediate steel arches. Light pine strips, running back from the coaming on the bow decking and notched to fit over the arches,

kept the hood taut. Subject to minor changes made on the voyage, this very simple bit of adjustable canvas did everything that was required of it both out on the lakes and in port.

The ideal installation for carrying gasoline would have been a light built-in tank. Filled with fuel and lubricant already mixed, a few pounds pressure from an air-pump would have permitted the replenishment of the tank of the motor at the turn of a cock in all weathers. I reluctantly decided against this arrangement because of the added weight, as well as the fact that I did not want anything that could not be quickly thrown overboard in the event of swamping. Several light cans of from one to three-gallon capacity promised to conform better to my requirements in these important respects than a fixed tank. The larger cans had handles and spring tops. The latter, released at a touch, permitted easy pouring into a funnel, yet fitted tightly enough to prevent leakage with the can lying on its side. Several spare funnels, each fitted with a close-mesh strainer, were provided for filling.

For filling in rough weather I was indebted to Mr. Evinrude for the suggestion of a simple but effective device consisting of three feet of one-inch rubber hose screwed to the top of a gallon can. The latter was to be kept filled with mixed oil and gasoline and stowed conveniently for use only in emergency.

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With the can held under either arm, it was easy to direct a stream from the hose into the tank of the motor with the boat bobbing around at a rate that would have spilled half of the gasoline poured in the ordinary way.

Government regulations for motor boats required a fog-horn, fire-extinguisher and two life-preservers. As standard cork-jackets, while affording more buoyancy than any other type, are not comfortable to wear, I supplemented those demanded by the law with a Gieve inflatable waistcoat, which I had worn in the British Navy during the War, and a kapok jacket that had given good service in the Grand Canyon voyage of the previous season. As either of these was light and flexible enough to be used as a coat, there was a better chance that one might be wearing it in the event of sudden emergency. Life-preservers are always useful on a small boat voyage quite aside from their original purpose. They serve as good pillows and rowing cushions, and nothing is better for terracing up a bed spot on a sloping bank or beach.

Everything else equal, I have always found it a good plan, in outfitting an open boat, to give preference to the article of utility that has the highest buoyancy. An inflatable rubber mattress, for instance, with a little air left in it on rolling up in the morning, has saved a bed roll for me on several occasions, and once provided a very grateful buffer for my own

abused anatomy in being carried down a rapid after an upset.

Although urged to carry a barometer by most of the Milwaukee yachtsmen whom I met, I decided to dispense with this normally indispensable instrument for two reasons. In the first place, it did not seem probable that the comparatively small barometer I could find place for would be sufficiently reliable to place full confidence in; in the second, I had far from enough practical knowledge of the meteorological eccentricities of the Great Lakes properly to interpret the significance of the readings of even an accurate instrument. There are times and conditions, for example, when, contrary to the general rule, fair weather follows a fall in the barometer, and unsettled weather a rise. Just where and when to expect such contradictions could only be learned by long experience of local conditions. Nowhere is the proverbial "little knowledge" a more dangerous thing than on the water. I felt that I would be better to depend as far as possible upon the Coast Guard stations for forecasts of major disturbances than to endeavor to set up a weather bureau of my own.

Having had personal experience of the efficacy of a sea-anchor in making it possible for a comparatively small craft to ride out the heaviest tropical hurricanes of both the Pacific and Atlantic, I was anxious to provide a miniature contrivance of this character for the

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present cruise. Mr. Evinrude agreed with me that something to hold the head to the wind and seas in the event of engine trouble in rough weather might well be the means of avoiding, in the succinct language of the German U-boat communique, being "*spurlos versenkt*." On learning that the smallest sea-anchors carried in stock by the ship chandlers were far too cumbersome for my little craft, I decided to take along the materials and make one as I had opportunity. Before intentions were translated into action, however, need arose which forced me to fall back upon a crude but far from ineffectual substitute improvised from a collapsible canvas bucket.

A sixteen-pound mushroom anchor promised sufficient utility, both routine and emergency, to warrant the addition of its weight to the outfit. It would be a help in mooring off-shore at points where it was impossible or unnecessary to land; also in securing the boat on beaches where there was nothing to run the painter to. More important still, it might serve to prevent drifting onto a lee shore in a storm. As inconvenient as it is to carry in an overloaded open boat, an anchor is too good insurance to risk omitting.

With the loaded boat too heavy to drag up a hard beach and sure to bury itself in a soft one, the best provision I could make against emergency landings was in the form of a couple of small rollers, trusting to supplement them with logs and planks for skid-



THE SPRAY-HOOD AT DOUBLE EXTENSION



MR. AND MRS. EVINRUDE (CENTRE)—MR. TELLENDAR
(RIGHT)—THE AUTHOR (LEFT)

ways when the time came. As there were no gun-wales to grasp forward, strips of half-round iron, bent to the form of handles, were bolted to both sides of the bow.

A pair of stout eight-foot ash oars were added to the rather light pair of spruce ones that came with the boat. Ring rowlocks were fitted to the oars, insuring against their loss save through breakage or upset. A forty-foot stern-line and a sixty-foot painter, with a hundred feet of fine manila line in reserve, completed the nautical gear. A step for a mast was fitted just aft the forward compartment, but only for the purpose of having it ready for a jury rig in case of trouble.

A complete set of spares of all the working parts of the motor were made up and packed in a stout fiber box, to be ready in case of trouble. Several score in number and ranging from the smallest screws and bolts to complete timers and propellers, these added many more pounds to the weight of the load I was striving so hard to keep down. With no certainty that a single part would be needed, there was at the same time a possibility that the lack of one of them might keep the engine out of commission indefinitely. It would not have been sensible, therefore, to leave the least of them behind.

The camping outfit was the same simple one I had used on most of my river voyages. An inflatable

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mattress, with a blanket and a strip of canvas comprised the bed-roll. An army mess kit of aluminum, with a few extra plates, spoons and small buckets, sufficed for cooking. A little two-burner gasoline stove that had proved a great comfort on the Missouri and Mississippi for cooking in the boat while afloat, was discarded at the last minute in favor of a diminutive "canned heat" contrivance that would go into my pocket. A hand-ax for chopping firewood and a canvas water-bucket made up the list of camp utilities.

With some of the finest fishing waters of North America on or near my route, and with both big and small game known to abound at many points, I regretfully omitted fishing tackle and guns from my outfit because there was little prospect of time to use them.

Of provisions I started with little more than an emergency ration of bacon, flour, cocoa, sugar and a few pounds of assorted canned goods. These were sufficient to hold me for several days in the event of being marooned on an out-of-the-way island or a remote part of the mainland. By buying fresh supplies as I went along and replenishing the staples as used, a minimum amount of room had to be reserved for provisions.

It was with this almost primitively simple outfit I was finally ready to push out into the still stormy lake on the first leg of the route my early springtime

dreams had led me to plan as a "quiet water" cruise in a fast and luxurious motor cruiser. I was well pleased with the change of program withal. There were reasons why I would have preferred a heavier boat, just as there were reasons why I would have preferred a lighter one. But there were other reasons, as I have explained, why limiting considerations made the outfit as finally assembled the best practicable compromise between the two. Without a great improvement of weather, the Great Lakes part of the voyage looked like a fight from end to end; yet quite the sort of a fight that there is a real zest in the winning of, with no disgrace attaching to failure.

There was good omen in the glowing red sunset of the day previous to that set for my departure; also in an official forecast which, for the first time in weeks, gave confident assurance of fair and settled weather for the next thirty-six hours.

CHAPTER II

UP THE WEST SHORE OF LAKE MICHIGAN

There is one particular—and one only—in which the man who sails the Great Lakes is better off than the navigator of the major salt water seas. That is on the score of the availability and dependability of weather forecasts. Completely surrounded by settled regions, reports of meteorological changes in every direction make it possible to forecast the approach of general storms with comparative certainty. On ocean coasts, on the other hand, the great seaward area is largely a blank from the forecaster's standpoint, and considerable disturbances may descend unheralded save by the sometimes cryptic barometer. Radio reports from ships plying the regular sea-lanes have mitigated this difficulty considerably, but such weather service is hardly comparable to that available in a region where the movements of storms can be charted hour by hour in whatever direction they are swooping.

Since by far the greater part of the course I had laid out for my voyage through the Lakes was to be along coasts where weather report could only be available belatedly if at all, there was really no great comfort to be extracted from a condition of which only

the regular navigator could take full advantage. That I did take some heart from it, however, was due to the fact that regular Weather Bureau service was going to be available to the several Coast Guard stations located at convenient intervals along the first, and conceivably the worst, leg of my voyage—the open and stormy west coast of Lake Michigan. With everything still to learn about Great Lakes navigational conditions, this, with reasonable care and luck, would give a fair chance to get shaken down for the work along the wilder and more unsettled coasts farther along.

The fair weather promised for the day set for my departure from Milwaukee came on as forecast. The morning was mild, windless and cloudless, with not even a blur of murkiness hanging as a threat on the north-eastern horizon. I was to learn later that most of the days that came with these smiling, shining morning faces had clubs behind their backs in the way of afternoon thunder-squalls. But this day was an exception, bent on playing out the game with the cards thrown down on the table at the opening dawn-time deal.

A highly welcome recruit for the run as far as Green Bay turned up at the last moment in the person of Newell Tellander of the Milwaukee Yacht Club. He had just brought his own yawl through the tail of the late storm from somewhere on the northern

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lake, but was quite unable to resist the temptation to find out at first hand how the same waters would behave to a rowboat. For my part, overloaded though my little craft promised to be, I was only too glad to have with me for the initiatory period one of the most experienced of Lake Michigan yachtsmen. I was especially pleased at the prospect of having potential help available in the event of a forced landing in rough weather. Just how my boat was going to be taken in through breakers and beached was a problem which I knew was going to take a deal of solving, and it was reassuring to know that my first tentative experiments would have the benefit of an extra head and hand.

To the accompaniment of the cheers of crowds on the bridges and the tooting of whistles, we launched the boat into the oil- and coal-dust-streaked tongue of water called the Milwaukee River and started for the Yacht Club on the outer harbor. It was like throwing a snow-baby into a pit of tar, with the consequence that what were one moment glossy dove-gray sides, sparkling under a coat of indurated spar varnish as the boat flashed through the sunlight on her maiden plunge, were transformed in an instant to the dusky, unrefulgent smeariness of the bows of a self-dumping coal-barge. Lohengrin's homing swan trying to navigate the great pitch lake of Trinidad couldn't have made a sadder mess of it. And that was the launch-



OIL AND GASOLINE MIXED FOR AN OUTBOARD MOTOR



CROWD AT OUR DEPARTURE FROM MILWAUKEE

ing, the occasion so carefully and prayerfully prepared for by sailors that all may be propitious and of good omen! No wonder our friends at the Yacht Club asked if we'd replaced the traditional bottle of champagne with a coal-hod.

And the omen of that far from auspicious launching was singularly prophetic. A month and a half later—running through Harlem River and Hell Gate and across Long Island Sound to Flushing—the voyage that had begun in a mile of oil and coal-dust finished in ten miles of garbage. Yet between these unsavory havens of departure and arrival stretched two thousand miles of the cleanest, greenest water, and half a hundred days of the liveliest and most exhilarating navigating I have ever known.

What with a farewell luncheon party at the Yacht Club and the infinite odds and ends of loading, trimming and a final shake-down of outfit, it was close to four-thirty before we were ready to make a start. With the addition of Tellander's weight the boat sat even lower in the water than I had anticipated; but that was not a matter to worry about until the wind and sea came up. With the surface of the lake like that of a mill-pond, one could keep dry on a plank.

There was the usual flood of parting advice and admonition, most of it superfluous. That of Captain Kincaide, in command of the Milwaukee Coast Guard station, coming from a man with one of the most

notable life-saving records in the service, could not be taken otherwise than seriously.

“Hug the coast pretty close all the way round the west and north shores of Michigan,” he said. “After you get to the Straits of Mackinac you will have islands to dodge behind most of the way to the foot of Georgian Bay. But don’t take any unnecessary chances along the open coasts of Lake Michigan. Don’t leave harbor if the weather is threatening, and if it becomes threatening while you are out, head for the nearest shore and make your landing before the seas get up. Don’t risk keeping out on the lake with bad weather coming up from any direction. A squall off the land may blow you out into the middle of the lake even if it doesn’t swamp you, while one from the lake will quickly get up such a sea that you can’t count on making a safe landing through the breakers. You’ll find it a good rule not to get over four or five miles offshore at any time, no matter how much distance you can save by cutting from point to point.”

“But on a day of really settled weather—” I started to protest. I was ready enough to keep port in storms, but still harbored an idea that lost time could be made up by cutting corners when the going was good in between.

Wrinkles etched by a hundred storms on Captain Kincaide’s weather beaten face deepened and length-

ened as he tried to repress a smile of amused indulgence.

"I forgot you were a stranger to these waters," he said, half apologetically; "else you'd know that there isn't such a thing as settled weather on the Great Lakes, either in summer or winter. The fairest morning is likely to give you the foulest afternoon. You can't take liberties with them in a ten thousand-ton freighter, let alone a cockleshell like this one. Better play safe by keeping where you can beach ahead of bad weather. It's better to be safe than sorry."

It has since occurred to me that these few simple admonitions of Captain Kincaide's might be framed as an epitome of directions for rowboat and canoe navigation of the Great Lakes. My respect for the wisdom of them increased with experience, and especially as a sequel to the events following the one occasion on which I held them in flagrant disregard. Just as long as I kept them well in mind and acted accordingly, I was safe, or comparatively so; and the time I failed to heed them I was sorry, very sorry indeed.

With but four hours of daylight left, Port Washington, thirty miles to the north, was the only convenient harbor to be made for the night. Running out through the anchored yachting fleet, we headed up

for the north entrance of Milwaukee Harbor. The water was still glassy smooth, with barely a lop against the sides of a breakwater which, three days previously, I had seen almost completely obscured by the heavy surges crashing in against it from the lake. Outside was a continuation of the mirrorlike calm, with the glistening blue-green surface of the lake stretching unbroken to where water and sky merged in the slaty blur of smoke floating above the main steamer track.

Running due north, we passed close to the concrete crib of the old Milwaukee water works and headed up the bluff coast. Water with barely enough movement to sparkle in the declining afternoon sun lapped an unending ribbon of silver-bright beach, with patches of sward behind and knots of trees still fresh with early summer's new leafiness. A flock of ducks floated lazily, doubled in size by their reflections in the mirror below. Seaward, a sloop with drooping sail, becalmed, waited for a breath of evening breeze.

There was something strangely familiar in the almost Nirvanic calm of that unwinding diorama of seacape and landscape which not even the staccato of a hard-hitting little motor could quite dispel, and presently I recalled what it was. It was the Great Lakes as I had first glimpsed them, the characteristic Great Lakes picture which had been in my mind when I planned my original "quiet water" voyage—"just

one silver strand after another bordering long narrow reaches of water that were as flat and blue in real life as upon the maps." And as a sibyl of old saw visions form in the fumes of her witch-fire, I gazed through the thin blue smoke above a motor purposely over-oiled while it ran off its factory stiffness and dreamed of a dream come true. Or rather, I had just got well started dreaming when Tellander spoiled it, all by beginning a recital of how, four days previously, his yawl had been hove-to all night in a sixty-mile gale just a few miles to the north.

"You probably won't see another day like this to the end of your voyage," he added in conclusion. That from the man I had taken along for comfort and reassurance. And yet he was quite right, as the sequel proved. Never again were the conditions altogether right to conjure up once more the "typical Great Lakes picture" which had persisted through the years finally to lure me to plan the "quiet water" voyage upon which I was now embarked. But it was something to have the start melt into the ideal composition of the old picture anyhow.

A couple of miles of Milwaukee suburban homes, molded persuasively to the contours of the hills back of the bluffs, was followed by a zone of ampler country estates, and these by great, rich, rolling farms, with endless lines of cattle winding down sylvan lanes to the big red barns and the milking sheds. The white

beach and the green-streaked brown bluffs still ran on, but with few signs of life. Boat-houses were conspicuously absent. The lake-front was evidently the back-door of the countryside, and a very slightly used one at that. Along the open west shore of Lake Michigan the use of small boats is almost entirely confined to the insignificant stretches protected by breakwaters.

The little Elto was hitting smoothly and steadily, driving the heavily loaded boat at a speed which a check over a known distance between two points proved to be better than eight miles an hour. While this was much faster than I had hoped for, especially until the motor had been thoroughly "run in," I knew that the real test of power would not come until it had worked out in the broken water that was to be expected far more frequently than smooth. I was still somewhat dubious of the ability of an outboard motor to drive a heavily laden boat against head seas, and I was distinctly apprehensive of what would be the effect of following seas slopping over it. Those were points upon which there would be ample opportunity for enhanced knowledge without long delay. For the present it was highly encouraging to find that I was getting so satisfactory a speed from a motor which could be tilted up at a moment's notice and leave me free to maneuver for a landing with the oars whenever the lake showed signs of developing a puni-

tive mood. The feeling that I had an outfit that could be beached in an emergency, rather than to have to attempt to ride out a storm as an alternative to making a perhaps distant harbor, was an unfailing reassurance from first to last.

Passing Fox Point, fifteen miles north of Milwaukee, the dark sage-green depths of the waters under the bow paled through olive to glittering jade before a flutter of golden-brown light-motes revealed that the sun was striking through to the sand and rocks of a rapidly shoaling bottom. Sheering sharply off until the liquid color symphony began to run the reverse of the scale toward the deeper green of ample depth, I headed back to the Port Washington course again. This maneuver was repeated twice or thrice in the next ten miles, where slender knife-like shoals stabbed lakeward for a mile or more from the shore. The shallowest of these had water enough and to spare for a craft of my draught, but there had not yet been a chance to study the chart and be sure. I had also been warned that the lowering of the lake level by the Chicago Drainage Canal made it necessary to deduct from two to three feet from the last charted soundings, so was not bent on taking chances in any event.

As a matter of fact there are few if any shoals between Chicago and Green Bay dangerous to a craft of less than three feet draught at over half a mile from

the shore. Beyond the mouth of Green Bay it is quite another story. For unexpected shoaling many miles from shore even the coral claws of the Great Barrier Reef north-east of Australia are not more treacherous than the north coasts of Lake Michigan and Lake Huron, including Georgian Bay. There is nothing more beautiful than the shifting colors thrown back through clear water from a shoaling bottom, but the ideal vantage from which to view it is an airplane or balloon rather than a scudding craft that is in danger of knocking off a propeller every time the color scale is keyed a note above dun-green. *That* took the poetry out of the thing even before I had bumped; after I had replaced sheared propeller-pins all around the north end of Lake Huron I was in a condition that set me pulling imaginary tiller ropes every time a yellow patch of paper caught the tail of my eye on the pavement of a city street.

A church-spire pricked in dark silhouette against the sunset flush of the north-west was the first sign of Port Washington; then the loom of factories, with the dark blur of jetties running out from the shore-line. A fixed red light flashing out through the wine-dark shadows of the bluffs gave a bearing for the end of the north pier and guided us into the entrance of the channel of the artificial Y-shaped harbor just as the purple of twilight was deepening to the velvet of



A VIEW OF GREEN BAY FROM EAGLE BLUFF



COASTGUARD PRACTICE

night. The last pop of the second filling of gasoline gave just way enough to slide the boat along to a mooring against the rotten log wall of the north basin. We had made the thirty-mile run in a little under four hours, and on exactly two gallons of gasoline.

What we had taken to be a welcoming delegation of natives waiting on the jetty to receive us turned out to be a party of friends from Milwaukee, who had motored over in the Evinrude car to bring some belated mail and, incidentally, a wonderfully appetizing supper basket. Leaving the boat in the care of a bunch of gamins who swore to defend it to their last breaths from a rival gang of pirates who rendezvoused in old coal hulk on the other side of the harbor, we kicked the cinders of the jetty from our feet and made *al fresco* banquet on the grassy banks of a cold spring above the beach.

Our gang was still on guard when Tellander and I returned to the boat a couple of hours later. There is nothing like giving street gamins a job and putting them on their honor. I daresay this same little band of swashbucklers would have looted our argosy from stem to stern had we tried to intimidate them with threats. As it was they hung on till midnight swapping yarns with us, and at dawn the next morning two of them came back dragging an anchor and a roller which they claimed had been the spoils of a

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recent raid on the craft of their rivals. I declined the sprawling mud-hook but accepted the roller with gratitude. It stood me in good stead on several occasions of real need.

Sleeping on the bank beside our boat, we rolled out at daybreak and went over to the little town for breakfast. A distinct overnight change in weather conditions was apparent as soon as we came out on the lake-front. The sky overhead was still clear, but a brisk, steadily-purring, purposeful little breeze from the south-east gave an unmistakable impression that it was going somewhere to equalize the pressure in a sizable hole in the atmosphere. With no place at which a weather forecast could be obtained at that hour, we consulted the barometer in front of a local drug store, to find that the optimistic 29.55 of the previous evening was down twenty points and still dropping. Checking this with the notes under "Wind-Barometer Indications" in the compact little handbook of the Lake Michigan Yachting Association, we found a warning which seemed to fit the case in the following:

"When the wind sets in from points between south and south-east and the barometer falls steadily, a storm is approaching from the west or north-west, and its center will pass near or north of the observer within twelve to twenty-four hours, with wind shifting to the north-west by way of south-west and west."

While the threat was far from tangible enough to seem to warrant remaining in port, there was plainly a day ahead on which it was going to be in order to keep a weather-eye lifting, especially along toward evening when whatever it was that was brewing up to the north-west began to boil over. Accordingly, we cast off at seven, determined to keep within easy reach of the beach all day.

A half hour's spell at the oars by way of warming up proved the boat's pulling qualities all that her fine lines promised. A few miles north of Port Washington we came to the first "pound" net, forming what appeared to be an impassable barrier reaching from near the beach for a mile or two into the lake. These nets are supported by lines run between piles and reach from the surface of the water to the bottom. This completely blocks the path of all fish entering the zone of the net, with the consequence that they finally work along into one of the series of traps or "pounds," from which they are lifted by the fishing boats. On account of the great cost of building and maintaining the nets, this is perhaps the most expensive form of fishing and is only warranted where sufficiently large catches are calculated to pay adequate returns on the investment.

Exploring the first net barrier under oars, we found, just outside of one of the "pounds," a place where the supporting rope was lowered sufficiently to

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allow the passage of the boat. We subsequently discovered that this opening was a regular feature, provided to facilitate the movements of the small craft of the fishermen in lifting a catch. By keeping careful watch, we soon learned how to shoot the boat through by shutting off the motor and tilting the propeller without recourse to the oars.

Slowed down materially by our zigzag course through the almost interminable series of nets, it was eleven o'clock before we headed into Sheboygan Harbor, twenty-five miles north of Port Washington. We could have saved time by lunching in the boat and pushing on ahead, but, with the wind freshening and the clouds piling ominously in the north-west, it seemed wisest to run in for a word of advice from the Coast Guard station. Sheboygan Harbor is typical of practically every port along the open west coast of Lake Michigan. The muddy estuary of a little river breaking through the bluffs determined the location, and the harbor—the earliest work upon which dates back over fifty years—was made by dredging a channel through the bar to the slough and protecting it with jetties. As the convenient logs from the then near-by forests were used for piers and jetties in the first instance, with repairs and replacements continuing to be made in the same perishable material, the works of all except the large terminal ports of Lake Michigan are far from modern.

THE SHORE OF LAKE MICHIGAN 37

The Coast Guard station, spotlessly white buildings in the midst of green lawns, is located near the inner end of the old north pier stub. The Captain, who had already been advised from Milwaukee to be on the watch for our boat in one form or another, received us most kindly and appeared highly interested in the voyage. He had received a warning of "violent thunder squalls accompanied by high winds," but from his own observations was inclined to the opinion that the weight of the onslaught would be felt farther south. As we would be running away from the center of the disturbance, he thought we would be safe enough in pushing ahead, especially if we kept in close and made a point of landing in event the west began to look too black.

Knowing this was the advice of an old lake sailor, thoroughly familiar with the coast and the limitations of our craft, we had no hesitation in following it. The fact that he already knew something of Tellander's reputation as a small boat sailor doubtless had a good deal to do with the fact that the Captain was ready to let us take the chance. Your average landsman, under similar circumstances, would have greatly exaggerated dangers of which he had no real comprehension and tried to frighten us into keeping port for a week.

After having lunch in Sheboygan—a prosperous lumbering and manufacturing town backed by rich

agricultural country—we got under way again at two, hoping to make a direct run to Two Rivers, where the next Coast Guard station was located. The most direct course took us from two to three miles off shore, and along this we bowled at a fine rate before the small but lively seas kicked up the freshening south-east wind. An occasional lop flipped over the star-board quarter, but considering her slight freeboard the boat made excellent weather of it.

Toward four o'clock, with the thunderheads starting to boil up purple-black from some devil's cauldron over beyond the western hills, I began to edge shoreward. Although the squalls were plainly working south-easterly in a way that promised to bring them to the lake some miles astern, I was too familiar with the trick of their South Pacific brethren of working back and springing an unexpected ambush to take too many chances. In spite of an apparent tendency to maneuver for a little surprise of this kind, the general direction of the storm continued just southerly enough to give us a comfortable berth. But where it was breaking upon the coast, but a few miles south of Sheboygan, the effect was positively cyclonic. Shot through and through with forkèd shafts of lightning, sinister cylinders of cloud rose above the amorphous mass of the driving storm like the turrets of a firing battleship. Mingled sunlight and lightning filtered through the churning clouds to cast lurid

patches of glow, like the fumes from sulphur and molten copper, on wind-flattened forests that were only less black than the ebony waters of the lake.

But all that turmoil was miles astern of us. The only time we appeared to be actively threatened was when a wildly spinning whorl of murky nimbus—a sort of looting camp-follower of the main army—flew off on a tangent from the parent mass and came charging down on us like a bull at a gate. That was just the sort of an attack we had been expecting, and, already in slickers and sou'-westers, we were making quick work of the scant three hundred yards to a clear loop of soft beach when the roaring *amok* succumbed to the southerly drive of the higher air currents and was hustled back into line. It missed us by a good quarter of a mile, with nothing but scurrying gusts of icy air and a spiteful spatter of hail to show what had been in pickle for us.

Inky clouds continued to boil up from behind the western hills all afternoon, but without driving close enough to our course to be more than potentially threatening. Not many miles to the south, however, it was plain that a storm of near-cyclonic intensity was raging. It was with no surprise, therefore, that we read in papers picked up the following day of very considerable destruction by hail and violent winds in Milwaukee, Racine and the farming region to the west.

On the whole, in demonstrating how comparatively easy it was to get into a position to land before a storm became dangerous, the experience was as reassuring as exhilarating. As a matter of fact, it was just a bit too reassuring. A black, blustering storm that one can see coming ten miles away is only one of the fifty-seven varieties of meteorological disturbances tucked away in the capacious weather-bag of the Great Lakes to be loosed with careless impartiality upon the wary and unwary alike.

Our dodge shoreward had carried us well inside a shallow bay that must have once been the harbor of the little picture-book hamlet discovered as soon as the passing of the squall menace let us take our eyes off the heavens and bring them back to land and lake. Doubtless a live lumber port many years previously, the railroad and the steamers had passed it by, leaving it in a back-water behind the rotting piling of its once busy docks, just a straggle of apple- and lilac-bloom smothered houses bordering a grassy road running down to the beach. Alluring as a drop-curtain scene as we saw it in the transforming light of a calcium-like glow where the sun strained through the silver lining of a storm-cloud, we were saved the disillusionment which must inevitably have followed a landing by the necessity of pushing on while the going was good.

Two little sirens in gingham, perched Lorelei-like

with idle fish-poles on the end of the battered pier, volunteered that the name of the dream-village was Centerville. When we begged to know what it was the center of, they looked at us quite blankly, entirely at a loss for an answer. I have met the same surprised stare from the almond eyes of a Hangechow mandarin when I asked why they called China "The Middle Kingdom." The pinnacle of unsophistication lies in fancying oneself in the heart of the great central Whorl of Things; also of hypersophistication. New Yorkers and Londoners are just a bit like the founders of Centerville and China in that respect.

But this particular brace of rail-birds was emancipated, broadened by travel and contact with the world. They had been to Manitowoc, all the way around the next point. Now *that* was a town for you; not like Centerville, which wasn't no kind of a place nohow, with no movies or nothin'. Now Manitowoc—we weren't bound for Manitowoc, by any chance, were we? And would we mind——

Sensing the imminent descent of upwards of two hundred pounds more of ill-stowable ballast into my overloaded boat, I spun the fly-wheel with hard-flipped wrist and put a broadening wake of bubbles between our stern and danger. It has never been recorded what was said by the sirens of old when the triple-banked oars of a galley backed water and slid away out of danger. All this pair said was, "'Fraid

cat! 'Fraid cat!" many times repeated. They were quite right, too. I doubt if the night-yodeling ladies of Scylla and Charybdis ever taunted in better point.

The thunder squalls were still going over the top in their charges from the western hills as we ran on north before the freshening south-easterly wind. As the deep bay leading in to Manitowoc opened up we had to decide between following the coast-line or standing straight on across to Two Rivers, as originally planned. With the west still full of dynamite, the former would have been the safer and more sensible course. It was the chance of spending the night at a Coast Guard station and being five miles farther along in the morning that decided in favor of the direct run to Two Rivers. It was just the sort of thing that Captain Kincaide had warned against doing in unsettled weather, and it was largely fool's luck that there was no penalty to pay.

The breeze augmented considerably in force as we stood out across the bay, and in an astonishingly short space of time had rolled up seas of real weight and bulk. The boat rose buoyantly to the lift of them, but from the troughs their sizzling white crests loomed several feet above our heads. None of them was quite able to put green water over the stern, though time and again they burned their noses on the hot cylinders of the motor in their eager attempts. The boat yawed wildly before the quartering seas so

that holding to anything like a straight course became a difficult task. I was unfeignedly glad when we drove in past the breakwater light and ran on in quiet water to the Coast Guard station at the inner end of the north pier.

The Captain of the station, saying that the forecast was for a heavy storm during the night, had our boat lifted out on the slip and a place cleared for us to sleep in the boat-house. After dinner and a walk about the low-lying but picturesque little town, we returned to the station, where we sat up to a late hour while the man on watch told yarns of his years of service on the stormy north coast. There was less comfort in these recitals than I would have liked. According to the weather-beaten old veteran, the whole north coast was a wilderness, with the shore rocky and shoal-beset, and with no inhabitants but a few fishermen. I was a bit cheered when it finally transpired that he had never really been there. I was soon to learn, however, that the altogether forbidding picture was by no means an exaggerated one.

CHAPTER III

COASTING GREEN BAY

The storm which had been thundering to the west all day of June 11th discharged most of its venom during the night. The worst of it fell along the southern shores of the lake. Several violent squalls broke upon Two Rivers, but found our boat snugly covered on the slip of the Coast Guard station and ourselves equally immune under the roof of the boat-house. The weather in the morning, while far from settled, looked hardly threatening enough to keep port for. The twenty-five-mile run to Kewaunee was made in just over three hours. Cutting my course too fine in passing broad, rounding Rawley Point, I found myself in a nest of shoals, with several vicious fangs of rocks pushed up to within a foot or two of the surface. The breeze was too light to reveal these with broken water and the light too dull to make them visible more than a couple of boat lengths away. After nicking one of these with the propeller (fortunately without injuring the latter), I tilted the motor and threaded my way out of the maze under oars. This was the first of many occasions on which the automatic tilting of the motor saved it from serious damage. Subsequent collisions were responsible for the sheering of



GREEN BAY JUST OFF "DEATH'S DOOR"

many propeller pins but never for the loss of the wheel itself.

The Kewaunee Coast Guard station had a forecast of "Thunder showers" for the afternoon, but the Captain was inclined to believe they would not be severe to the north. He warned us especially of barely covered shoals along the shore and advised keeping out from two to three miles the first quarter of the way to the lake entrance of the Sturgeon Bay Canal, our next objective. Just how troublesome these shoals would prove in the event of a forced landing we did not, fortunately, have a chance to find out. A drizzling rain from leaden skies rather than thunder squalls prevailed most of the afternoon, so that there was no occasion to deviate from an outside course in deep water. The beach showed more rocks and less sand the farther north we fared, and just before reaching the Canal a ridge of white limestone appeared, the forerunner of the beautiful cliffs fringing most of Green Bay and the islands about its mouth.

The course we were about to follow through Sturgeon Bay Canal and north along the eastern shores of Green Bay was considerably longer than the direct one up the outside of the peninsula. It had been universally recommended to us, however, both because it was better protected and because it ran through some of the most beautiful waters of the Great Lakes. The slender easterly reaching finger of Sturgeon Bay

cuts five-sixths of the distance through the narrow peninsula separating Green Bay from the main lake, so that a shallow excavation of 7200 feet was all that was needed to unite the waters. This was done by a private company during the years between 1872 and 1881. The United States Government took over control in 1893, and in the course of the next decade deepened it to fifteen feet and widened it to one hundred and sixty. The lake end of the canal is enclosed by two converging piers, each over a thousand feet in length, forming a stilling basin that is called by courtesy a "Harbor of Refuge." The area enclosed, as the War Department Bulletin describing it admits, is too small to be of any value as a refuge for ships and is of use only in affording protection to the entrance to the canal.

Running in between the piers toward the Coast Guard station on the north bank of the canal, we observed, in a line of uniformed men forming up along the wall, what appeared to be the preparations for our first formal welcome. Assuming that some kind of an address presenting us with the Freedom of the Canal was about to be made, Tellander and I fell into hot debate as to which one of us should have the pleasure of listening to the other make the response. The decision was still in the balance when we bumped alongside, quickly to learn that we had been giving ourselves unnecessary concern in the matter of a re-

sponse to a speech of welcome. The welcome had been carefully prepared, it is true, but it was a negative one, taking the form of a rough and undignified tumbling out of the contents of our boat while a very dour-faced Captain checked the items from a yellow paper. When I, thinking the search was possibly a routine one of motor boats at the canal, interposed to say that all government requirements in the matter of life-preservers, fire-extinguisher and the like had been complied with, I was told bluntly that I would be given a chance to make a statement in due course; also that I might just as well be warned that anything I said would be held against me.

That cleared things up a bit respecting the lack of warmth in the welcome, so that I was not so much surprised when the Captain and the searchers, shaking their heads ominously, agreed with each other that "this sure looks like the outfit." Evidently having learned all that was necessary, the half dozen big strapping guardsmen formed a circle about us, handed me the yellow paper and demanded to know what we had to say to *that*. And the yellow paper cleared up everything. It was a police wire from Manitowoc asking all Coast Guard stations to be on the lookout for a gray, eighteen-foot, round-bottomed boat, fitted with lockers forward, which had been stolen by two men the previous day. There was also a list of things that had been taken with the boat, and,

without giving the items in detail, I may say that we had them all, even to a collapsible canvas bucket marked "U.S."

The identification appeared so complete that I could quite understand how our captors assumed the airs that would go with the feeling that there was nothing left to do but deliver up the prisoners and collect the reward. If they were surprised at the highly amused grins that sat upon the phizzes of the captives, it was nothing to the way they were caught a-back when I passed the Captain a copy of the Milwaukee paper with an account of our departure and a picture of the outfit in the river and at the Yacht Club. The best of it was that he had a copy of the same paper in his pocket, together with memoranda of 'phone messages from Coast Guard stations to the south asking him to be on the watch for us.

Fortunately the Captain was of Irish extraction, and so able to derive some enjoyment out of a joke on himself.

"They can't be saying I didn't keep a watch out for ye after all, bhoys," he exclaimed, clouting us both on the shoulder with a weighty paw. Then, with a flush of red around the fresh-shaven gill, "But I'd be appreciating it, just the same, if nayther of ye beat it to the phone to tell 'em just what kind of a watch it was I kept."

He was such a good sort of a chap, once the

Nemesis-of-the-Law manner was cast off, that both of us promised. This is the first time, indeed, that I myself have told the story by any medium, so that if it chances that it has already been put in circulation among the Coast Guard stations the responsibility must rest upon the Captain's other "prisoner."

Fifteen minutes' run through the excavated section of the canal took us out to the shallow waters of Sturgeon Bay and one of the most exquisitely beautiful sunsets at which I have ever caught breath or quickened pulse. One moment we were shut in between high banks of blasted fragments of limestone; the next this had fallen away like the wings of a stage setting and we were running through a mad rainbow revel of color that was swimming in the air, the earth and the waters under the earth. It was all of such an impossible dream-stuff sort of loveliness that for a space I could only gasp, and incidentally forget my steering until the bump of the bows on a channel-marking buoy shocked me back to reality again.

What had happened was really very simple—just a felicitous blending of three or four of Nature's moods and manifestations at the moment of sheer perfection. These were the "props" for the astonishingly splendid setting as catalogued after the pageant had faded: A glorious fair-weather sunset that throbbed through the whole scale of reds, from delicate rose-pink to vivid, flaming scarlet; a mile of gently sloping hill-

side blanketed almost solid with the virginal whiteness of newly opened buds of apple and cherry trees; a verdant stretch of sward running down to a zone of marsh thick-studded with the floating blossoms of yellow and white water-lilies; a reach of unrippling water stained to a bright golden-amber when it had drained down through the centuries-old layer of rotting woods beneath the moss of the fringing forests.

The kaleidoscopic riot of shifting colors was caused by the glow of the sunset striking down across the masses of cherry and apple bloom to be reflected in the golden mirror of the still waters of the bay. It would be as presumptuous as futile to attempt further to describe the result.

Running on a couple of miles to the water-front of the attractive little town of Sturgeon Bay, we tied up for the night in the slip of a boat-house a hundred yards above the draw-bridge which spans the narrow inlet. With the mosquitoes buzzing belligerently along the water, we were only too glad to accept the invitation of the owner of the boat-house to spread our beds on the veranda of his home, on the higher ground a hundred yards nearer the town. Our host, a genial Scot named McLean, had once made a voyage in a small motor boat around the north shore of Lake Michigan. He could give me little practical information about it, however, his rather hazy recol-

lections being only of a rocky coast with many shoals and few people.

Rolling out at sunrise from the lilac-scented nook where we had slept, we were greeted for the first time since the day of our departure with a bright, clear morning sky. As the day was Friday, the 13th, however, we were loath to believe there was not a catch in the thing somewhere, and so 'phoned to the Coast Guard station for verification of our own weather forecast. When this indicated that the Government Observer was also risking his reputation on fair weather, we no longer hesitated to face the combination of day and date dreaded by mariners above all others.

A 'phone to Tellander's office in Milwaukee brought word that business would demand his return the following morning, but the bad news was tempered by tidings that several other friends were leaving the same day to rendezvous with me at Ephraim, on Eagle Harbor, for a final farewell party before I passed beyond the zone of auto roads. A hasty going-over of the engine in McLean's machine shop revealed that the motor was working off its stiffness and settling down to its long grind without a visible symptom of an ache or a pain.

My entrance to Green Bay from the Sturgeon Bay Canal discovered a radical change in the character of

the coast-line. Soft sand beaches were left behind practically for good, to be replaced by white limestone cliffs in Green Bay and by various native rocks along the north shores of Michigan and Huron. In fair weather the rock-bound shores made little difference; in foul they promised greatly to complicate the problems of landing. But for the day at least the skies were fair, and it was in order to make the most of them.

For the first five miles north of Sturgeon Bay the shores were steep-to, so that we were able to run along in deep water a biscuit-toss from the cliffs with no need of keeping a lookout for lurking shoals. The cliffs were mostly sheer fractures of glistening white limestone, hard pressed from the rear by a surge of forest, with trees in that rare riot of freshness just following the spring budding. Spring had come even later than usual on the northern lakes, and it was to be my happy fortune to ride the frothing, fragrant crest of the wave of early summer all the way to the islands of Georgian Bay.

Green Bay is small only by comparison with Lake Michigan, from the north-western end of which it depends somewhat after the fashion of an over-ripe and slightly bruised banana from its parent stem. It is nearly twenty miles wide at Sturgeon Bay and not much narrower at any point between its head and mouth. Clear as was the day, we saw only the smokes

of the towns on the western shores, with the loom of hills showing but dimly at one or two points. We were not, therefore, running in anything approaching closely landlocked waters. The advantages the Bay afforded to small craft was in the lee its eastern shores provided against storms from the main lake and the availability of the shelter of small islands and a number of natural harbors, in both of which the west coast of the main lake was quite lacking. These advantages were partly offset by the openness of the Bay to northerly and westerly storms, and the fact that its very shallow waters were far more susceptible to the action of winds than were those of the deeper lake. It was Tellander's feeling, indeed, that, while it was easier to run to shelter in Green Bay, if it came to riding out a storm in a yawl or a schooner he would far prefer to take his chances in the big lake. For my own little shallop, however, there was no question but that I was far better off on the inside than the outside course.

Turning north-easterly with the bend of the coast five miles above Sturgeon Bay we had our first opportunity to try out the behavior of boat and engine with head wind and seas. The wind was a couple of points off the port bow and just strong enough to stir the clear, shallow water up into waves a degree less than white-caps. The fine flare of the bows clove through them admirably, with most of the spray

blown back being deflected by the first extension of the hood. With the boat deep down as she was, it was inevitable that some green water would pour over the windward gunwale in the rolls, but we learned to avoid most of this by carefully timed balancing. I was much encouraged to find that the propeller kept well buried even when the bow plunged into a trough, and so lost little if any of its forward-driving thrust. It was not near to threshing clear of the water and racing in empty air at any time; neither did the buffetings of the seas on the bows appear greatly to retard headway. I must, of course, expect weather in which there would be difficulties on all of these counts; at the same time it appeared that I was going to be able to keep the lake, and even make substantial progress, against conditions of wind and sea which I had hitherto been inclined to regard as prohibitive.

Egg Harbor, with its summer resort hotels, offered a convenient lunch stop, but we decided in favor of saving time and distance by standing on to Eagle Harbor for a party of our own on the beach. Rounding Eagle Bluff after passing the low, flat Strawberry Islands, we skirted Horseshoe Island and ran in to a landing on the inner beach of Shanty Bay. The latter is a southerly arm of Eagle Harbor and is distinguished as one of the few spots along the northern shores of Green Bay still uninvaded by the summer hotel or the (at times and places) almost equally ir-



THE STRAWBERRY ISLANDS

ritating "paying guest farms." A rotting landing and an abandoned cabin all but obscured by apple-bloom told of ancient inhabitants, but of latter day occupations there was almost no sign.

And so in this delectable bit of wilderness Tellander and I made our first and our last joint camp. An explorative clamber through the woods, a swim where the golden-hued water was warmed in the embrace of a sun-baked loop of sand, a supper in which the camp culinary cunning of the both of us was expressed to the nth power, with a crackling pyrotechnical fire of birch-logs as a grand finale, conspired to carry the day to a climacteric pitch of idyllic perfection. Buzzing, boring mosquitoes that stung and clung and refused to give o'er their relentless fight for blood until the chill gray dawn of the morning after, came rather in the way of an anticlimax.

With the shrill trumpetings of the reënforced enemy sounding to renewed assault with the rising of the sun, no further reveille was needed to roll us out for full retreat. Bathing swollen heads and hands in the cool water of the bay, we tossed off hastily brewed basins of coffee in the grateful smudge of rotten wood, threw our outfit helter-skelter into the boat and scudded away in a protecting smoke-screen of oil and gas to where civilization and safety beckoned behind the jetties of Ephraim.

It is always the initiatory battle with mosquitoes

that is the bloodiest. Physical and mental immunity comes quickly with constant exposure, and finally brings the familiarity that breeds contempt. And an attitude of contempt is quite fitting and desirable with the mosquito of temperate regions which carries no malaria of yellow fever on the tip of its snout. With the festive anopheles and his brethren of the tropics it is, of course, quite another matter. I may add that, even as temperate zone mosquitoes go, those of the shores of the Great Lakes are a slight annoyance compared with the blood-thirsty hordes of such regions as the upper Missouri and lower Mississippi Rivers and practically all of Alaska. Doubtless, too, they serve a useful purpose in bringing the over-ecstatic camper back to earth now and then, like the fleas on the mongrel that David Harum reckoned were put there to keep him from forgetting that he was only a dog.

Tellander, his absence to be deeply and frequently regretted during all of the remainder of the voyage, caught the early bus out of Ephraim, en route to his neglected office. Toward mid-afternoon, while a considerable portion of the population—both permanent and transient—was gathered to give me practical advice on shaking down my outfit for the next leg of the voyage, two cars rolled down to the landing. One of them brought Ole and Mrs. Evinrude and their son, Ralph, just home from school; the other contained my

genial playwright friend, Bernard K. Burns, and Mrs. Burns. The Evinrudes had been planning the little *bon voyage* party when I left Milwaukee; but Burns, fresh from his Broadway success with "The Woman on the Jury" and headed for the woods to work on a new play, was only deflected up the peninsula at the last moment. The sequel was a wholly delightful week-end spent fishing, boating and motor-ing over a uniquely beautiful countryside. Wisconsin has acted wisely in setting aside as a State Park a considerable area bordering the south side of Eagle Harbor. I know of nothing quite like it anywhere else in the Western Hemisphere.

Mr. Evinrude brought word of several volunteers who were anxious to rush on to sign up with me in various and sundry capacities for the rest of the voyage. One of these—an ex-Coast Guardsman and naval service man—gave some promise of qualifications that would have made him really useful in the work ahead. Glad as I would have been, however, for the presence of potential help in the event of a forced landing with a craft that I knew was too heavy for me to handle quickly alone, I was still unwilling to handicap the boat in rough water with any more weight than was absolutely necessary. Neither did I care to take on, "sight unseen," a complete stranger. An eighty-foot schooner is all too small for two men so constituted as not to be able to look at work, play

and life generally through pretty much the same eyes; and a small open boat in like event could hardly fail to be one degree worse than hopeless. As a matter of fact, out of a score or more of friends with whom I would feel comparatively content in embarking upon an extended yachting cruise, I could number on one hand those with whom I would be optimistic of developments in shipping for a month in a small boat. So it was with neither qualms nor regrets that I declined the services of all further candidates for a "crew."

I had expected to push off alone on Monday morning, the 16th, but another fine day and the prospect of watching one of his engines work out against a lively run of head seas with a heavy boat proved too much for Ole Evinrude to resist. So it was arranged that he should accompany me as passenger on the fifteen-mile run to Hedgehog Harbor, at the northern point of the peninsula, where Mrs. Evinrude and their son would go by road to pick him up for the return drive to Milwaukee.

We ran out off into a light northerly head wind, with occasional gusts drawing down over the bluffs indicating that it would be met coming from the east beyond the peninsula in some strength. Any hopes I may have entertained of making Mr. Evinrude work his passage by giving me an intensive course of instruction in the idiosyncrasies of his little brain-child popping away on the stern were doomed to disap-

pointment. Casually remarking that the motor was "spinning like a top," the wizard of the outboard launched into a series of yarns anent the adventures attending the cruises of his old *Bess Emily* in the waters we were about to enter. They mostly had to do with clawing off lee shores in sudden squalls, banging over half-submerged reefs in the dark, and all the other odds and ends of intriguing little incidents that the yachtsman so loves to dwell upon in retrospect, especially for the edification of the younger Ulysses who navigates locally for the first time. The gist of it all seemed to be that the north coast of Green Bay and the islands thereof was no place for a forty-foot motor cruiser in anything but fair weather. But as to whether or not they ever had fair weather nothing was said; the talk was all of foul.

"Nothing very cheering in that from the open skiff standpoint," I muttered dejectedly, all my former apprehensions about the inadequacy of my little shallop surging anew in visualizing the problems conjured up by the dismal recitals.

"Oh, that's all right," encouraged the veteran with an airy wave of his hand. "You just tilt your motor and get your whole outfit up on the beach before ever the storm reaches you."

That had been my own idea, too, but there was really very little comfort in being reminded of it just as we chanced to be coasting a line of white bluffs that

fell sheer to the water for a hundred feet as far as the eye could reach in either direction. Perpendicular limestone walls, weather-worn to a surface slick enough to trip a fly, struck me as offering rather arduous landing conditions.

The Green Bay coast-line from Eagle Bluff to Porte des Morts is one of the finest scenic stretches to be found in all the Great Lakes. From one to two hundred feet in height, the bluffs through most of this distance rise straight from the clear, deep water which laps their bases. With two or three shallow bays offering some protection from storms from the main lake, the whole long line of bluffs is one of the worst places conceivable off which to be caught in a blow from the west.

Death's Door Bluff, which gives its name to the sinister Porte des Morts Passage, is the most northerly point of the Green Bay Peninsula. Its name originally appears to have been given in commemoration of an Indian legend, which told of a band of warriors, vanquished in battle, being driven over the cliffs into the lake at this point. Since the inauguration of navigation the rock-beset passage itself seems to have built up a tradition of its own, for the Lakes Survey Bulletin states that:

"It is known as 'Death's Door,' owing to the numerous detached reefs and shoals obstructing its navigation, and the strong currents setting in or out



EAGLE BLUFF NEAR EPHRAIM ON THE SHORES OF GREEN
BAY

according to the direction of the wind. The coast is rockbound and is almost certain destruction to crafts going ashore. These conditions have been the cause of many vessel disasters."

"Death's Door" made a flashing gesture of evil intent as we doubled its guardian bluff, but the gusty squall passed quickly and the short, broken seas stirred up by it died down rapidly as we headed east across Hedgehog Harbor and gained the lee of the hills running back from Table Bluff at the opposite side of the bay. At a quaint little cove that might have been transplanted bodily from the coast of Cornwall or Normandy or the Hebrides, we found Mrs. Evinrude and Ralph awaiting our arrival. With them was an ancient Scottish fisherman, so wrinkled and weather-beaten as to suggest that he might have pulled stroke-oar for the Ark in the pride of his youth. He was bristling with intimate personal reminiscences of the tragedies of "Death's Door," where he said as many lives had been lost during the break-up of the ice in the spring as in ship-wrecks.

The old fellow cackled with glee over the absurdity of my inquiry as to the possibility of getting a barometer reading before I shoved off, adding that he had all the weather-glass anyone could ask for right there in his bones. If it was a weather forecast I wanted, he could assure me that a wind was making over in the lake that would have the teeth of "Death's Door"

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laid bare right "doun to their gooms afore the mairn." There might even be a few breaths of loose air kicking round before night, he added, but hardly enough to keep a tight little craft like that of mine off the water, especially as I could make a lee of it most of the way round to the north-east corner of Washington Island. And, expressed in somewhat different language, those were practically the identical forecast and directions I received an hour later at the Coast Guard station on Plum Island.

Bidding good-by to old and new friends, I refilled the tank of the motor and pushed off at eleven, for the first time alone. The boat rode appreciably higher without a second passenger, with a distinct improvement in the ease with which I could balance her in avoiding the invasion of beam seas. This became apparent as soon as I had passed out of the lee of Table Bluff and began to shoot athwart the short but ugly cross-seas driven in before the freshening southeasterly wind from the lake. An unexpectedly strong inward set of current gave added weight to the seas, and the last mile to the lee of Plum Island, with wind and waves coming dead abeam, the boat bobbed about right merrily. She took much less water than I had anticipated under such conditions, however, and speed appeared to suffer very little from the heavy rolling. It was a very encouraging start for the "lone mariner" part of my voyage.



THE PERFECT HARBOR AT FAYETTE ON GREEN BAY



GOODBY TO OLE EVINRUDE AT HEDGEHOG HARBOR

Running along the west side of Plum Island, I cut a mile off the buoyed course to the Coast Guard station at the north-east corner by heading straight across a long shoal at a point where the old fisherman at Hedgehog Harbor had told me there would be just enough water to clear my propeller all the way over. This did not prove quite true, but as it was only soft sand that was bumped no harm was done. A few strokes with the oars sufficed to carry the boat on into deeper water, and five minutes later I was running in beside the station jetty.

Two of the guards came running down to help moor the boat and take me back to join them at their half-finished lunch. The Captain of the station was just packing up to leave on his summer vacation, but, with characteristic seaman's courtesy, postponed his departure for a half hour to go over the chart with me and discuss the route ahead. The rapidly falling barometer indicated a heavy storm from the lake beyond all doubt. As this might well hold me up for several days, Captain Moe agreed with me that it would be best to push on far as possible before it broke. He suggested the lighthouse station of St. Martin's Island as a good strategic point to endeavor to make that afternoon. There was adequate protection available for the boat, and it would be a favorable place from which to take-off for the long fifty-mile jump to Manistique, on the mainland of the

north shore of Lake Michigan, the next good harbor on my route. In view of the gustiness of the wind, evidently the vanguard of the coming storm, he advised a safe but circuitous course that would take me close along the sheltered west and north coasts of Washington Island, leaving the jump across open water to St. Martin's Island to the last, and reducing it to less than ten miles. I could find shelter at a wood camp on the south shore of St. Martin's Island if it was too rough to run around to the lighthouse, while there were two good harbors on the north shore of Washington Island in the event I had to scurry to shelter earlier in the afternoon.

Unlike the weather preceding the semi-cyclonic disturbances of the second day of the voyage, the wind was now blowing from, rather than to, the quarter from which the storm was expected. It was still clear overhead, as well as to the north and west, but an opaque bank of haze to the south-east was slowly extending to blur the whole lakeward skyline. The lookout on the Coast Guard station watch-tower reported white-caps on the main lake when I got under way again at one o'clock, but, sheltered by intervening islands and shoals, the water through which I ran for the first few miles was hardly more than rippled. Under the high bluffs of the west coast of Washington Island the clear green water was quiet as the surface of a millpond, and even when I rounded Bover

Bluff and headed across the deep indentation of Washington Harbor there was little to indicate to anyone not highly sapient of local weather conditions how much air was really stirring in the open passage a few miles to the northward.

It was this Judas-kissing calm and the soft airs of the lee of Washington Island that lured me into shooting straight across for St. Martin's, a dull gray-green blur on the horizon thirteen miles to the north-east, instead of following Captain Moe's injunction of keeping in as close as possible all the way. The direct course would not only have the advantage of saving time and distance, but would also bring me to St. Martin's at a point from which it would be much easier to reach the light-station than from the landing at the southern side. This perfectly sound reasoning was eventually justified, but without altering the truth of the cardinal fact (which was probably best learned at bitter first-hand anyway) that a broad, open passage already under the guns of an advancing storm is no place to venture with an open boat.

The increase of the force of the wind as I ran away from the shelter of the land was as gradual as it was unmistakable. Two miles out the crests of the steep, short waves were tipped with white, and not far beyond a good deal more than spray began to slop over the weather gunwale. As my north-easterly course brought the seas dead abeam, the spray-hood was of

little use in keeping water out of the open after section of the boat; nor did throttling down speed help greatly. Running dead into the eye of the wind with a slow engine kicked up wild splashes of spray, but most of it was carried back over the stern. Running before the wind, though the boat yawed crazily in the unrhythmic seas, was dryer still. I tried them all just to get a bit of an idea how things would be in the event it became impracticable to hold on my original course. Then I unlimbered my big bailing bucket and headed for the slowly broadening lee of St. Martin's beyond the ten miles of open water still intervening.

A thirty-foot cabin fishing launch, hastening to take in its nets before the storm broke, gave me the first idea of how rough it really was. With only a knot or two of way on, she was rolling rails under in the trough, with spray occasionally flying right over the deck of her high glassed-in cabin. She had evidently been a pleasure craft at one time, and of a design far from well adapted to the lowly work in hand. The fishermen were genial souls, and especially nice in the considerate way they refrained from seizing the opportunity to launch a flock of solemn warnings about the coming storm. One of them had a pleasant sort of dry wit, though. When I responded to his hail of "Whereaway, matey?" with a laconic "New York," he shook his head and roared back that the

weather didn't look favorable for making that port before dark. And another was a merry wag. When I asked, with a fine show of nonchalance, if the wind ever blew thereabouts, he replied that it "puffed away tol'ab' sma't" when it got its dander up, adding that, of the last launch he had wrecked, the engine was the only part that was found on the beach.

"And what became of the rest?" I asked quite naturally.

"All that was left o' the hull an' uppa-wuks we salvaged from the trees at the top of the bluff," he replied, laying back another layer of net along the pile on the bobbing stern.

But the good fellows were quite serious and sensible when, in similar mood, I asked what they thought of pushing on to St. Martin's. They would really welcome the chance to take me home with them to Jackson's Harbor, they said, but, since there was nothing in the next five miles worse than I had banged through for the last five, there was no reason why I should lose a day or two by departing from the most direct course. And quite right they proved to be. A little work with the bailing bucket every time the bilge began to swish about my ankles kept the water from rising to a dangerous level, and that was about all there was to it. Just as soon as I was well past the middle of the passage, indeed, and knew that I was wallowing along very comfortably through the worst of the welter, the

thing was really good fun; also distinctly heartening in uncovering qualities of seaworthiness in both boat and engine beyond my highest hopes for either. Confidence in my ability to avoid or ride out the worst the dread north coast of Lake Michigan had to offer in the weather line was pegged several notches higher by the time my drenched but buoyant little craft slid into the quiet green waters of the sheltered lee of St. Martin's. And the exaltation of high-pegged confidence is not conducive to the state of mind necessary for conservative navigation. That truth had been brought home to me a score of times in running river rapids; it was rather silly to have to learn it all over again on a lake.

The sun-brilliant bit of seascape flashing into view as I rounded the north-west point of St. Martin's seemed for an instant as though lifted bodily and transplanted from the South Pacific. Both color and form conspired to compass the illusion. It required slight stretch of the imagination to see in the loop of white limestone beach a shining strand of coral clinkers, in the white and red light-house buildings a mission or trading station, in the wind-stripped trees on a jutting point a patch of feather-topped coco palms, and in the combers breaking on the shoals of the low Gull Islands a South Sea surf thundering on a barrier reef. The tropical seeming faded as the eye searched for details, but the first vivid vision had been so real

as almost to bring the perfume of *frangipani* and *tiare Tahiti* on the wings of the gathering gale.

Running in past a long-deserted fishing village, with its sagging-roofed houses and rotting docks, I landed at the slip of the boat-house of the lighthouse station. The bronzed, broad-shouldered chap who dropped a paint brush to come down to greet me had a familiar look, which was explained when he introduced himself as Dave Kincaide, brother of the Captain of the Milwaukee Coast Guard station. With the bottom dropping out of the barometer, he said I might just as well reconcile myself to a stop of two or three days. He regretted that there was no sleeping room for me at the station, as his family from Washington Island was paying him its annual visit; but the boat-house was at my disposal for myself as well as my boat. His own launch, for convenience, was kept on the other side of the island. My suggestion that the boat would probably be all right if drawn up a few feet inside the narrow slip brought a chuckle and grin from both the veteran keeper and his assistant. Pointing to a line of driftwood well back toward the wall of the forest, Kincaide explained that a hauling of the storm to the north-east would be likely to send everything but the native bedrock underlying the beach up to join it. With that graphic example of a nor'easter's wrath before me, I was only too glad to have my shallop floated onto the car of the

little marine railway and hauled up by windlass into the boat-house.

Suppering bountifully at the table presided over by Mrs. Kincaide and her daughter, I sat late into the night listening to the keeper and his two assistants spin yarns of the years spent in buffeting the summer and winter storms of the treacherous *Porte des Morts* Passage and its equally grisly vestibules among the islands to the north. One of the last tales had to do with Kincaide's fight with a giant timber wolf, which had crossed from the Michigan forests on the winter ice. Phantom wolves chased me all the way back to my bed in the boat-house after that, and then sat down to howl outside. An hour or so after midnight their ululations were drowned in the roar of artillery—the batteries of the storm opening up in what proved to be an astonishingly earnest endeavor to blow the boat-house off the face of the island. Fortunately the cunning Government architects had contrived to anchor the squat little building against just such an onslaught, so that the only serious casualty revealed by the stormy dawn was Keeper Kincaide's freshly spread layer of white paint.

CHAPTER IV

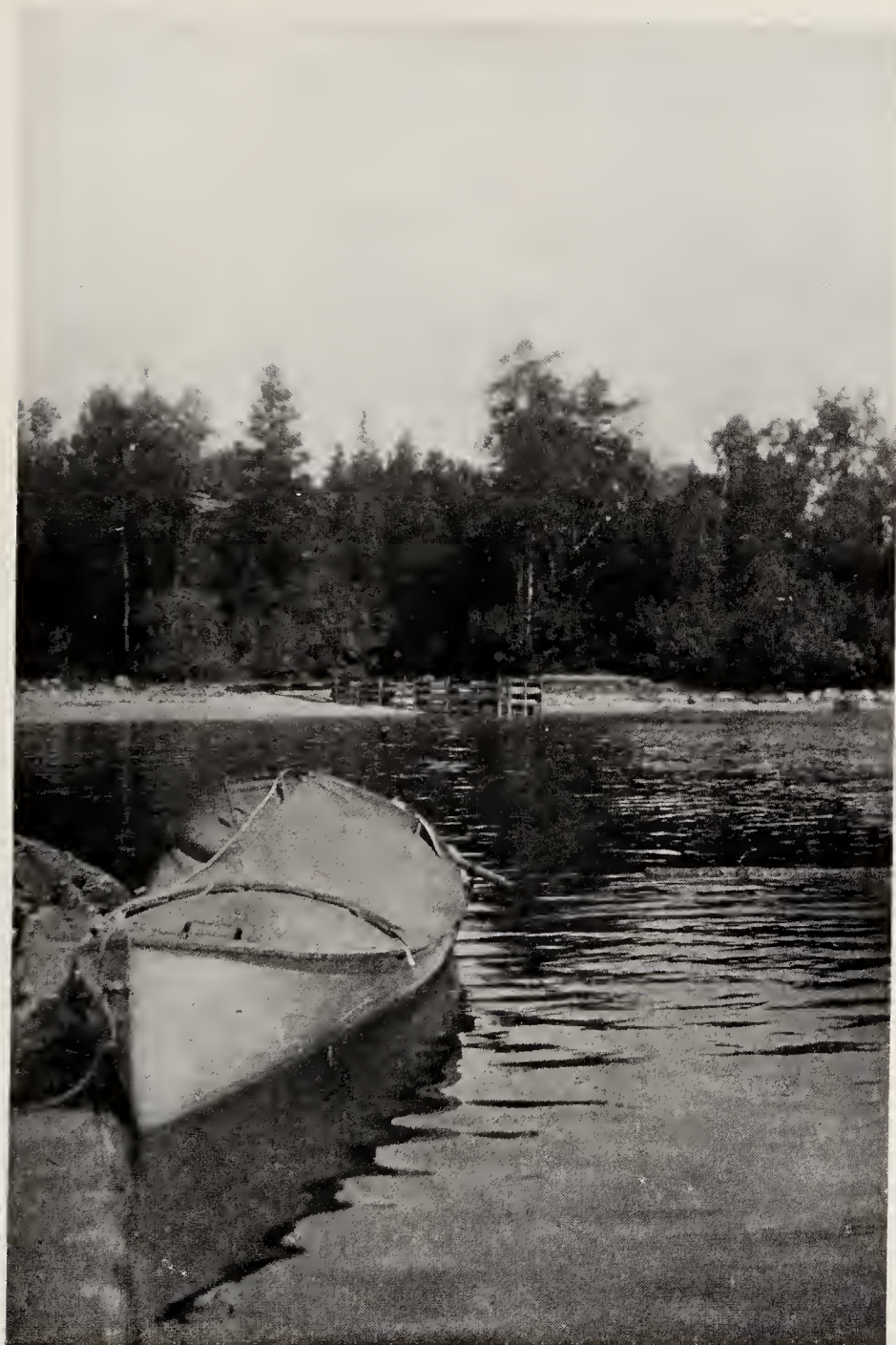
ON THE TRACKS OF THE VOYAGEURS

My departure from the island barrier at the mouth of Green Bay marked the beginning of what I had come to feel would be the most arduous, and yet at the same time the most interesting, stage of my voyage. From Milwaukee to and through the Sturgeon Bay Canal I had skirted a sandy-beached coast, with towns and harbors at frequent intervals and the intervening regions taken up with cultivated farms. Green Bay had presented a rocky coast, but one, withal, so thickly fringed with summer resorts that the navigator really ran more risk of colliding with pleasure craft than with shoals. But through the cliffy portals of "Death's Door" I had pushed into waters bordering a zone of comparative wilderness which, with only slight and rare breaks, would continue around the reef- and shoal-beset north coast of Michigan and Huron and on down to the foot of Georgian Bay. Hundreds of miles of this rocky and desolate mainland and island coast, though they had wooed the voyageur, had never won the settler; other extensive stretches, knowing ephemeral settlement, had reverted to wilderness under the blighting touch of the lumberman, who followed the forest primeval

west and left destruction in his wake. Nature, intervening to heal the man-made wounds, had restored to the ravaged regions a semblance of the smiling face they had presented to the red Indians and the pioneers. But the Indian and the voyageur had passed never to return, and the day of the permanent settler was not yet. The north coasts of Lakes Michigan and Huron, with their fringing islands, constitute in many respects the most attractive stretch of unspoiled wilderness in readily accessible regions of temperate North America.

Yet the appeal to fancy in the promise of action along the rock-bound, half-forgotten coasts and channels ahead was not stronger than the challenge of the record of my predecessors, "The Men Who Had Shown the Way." The tangible lure of the Present was not more potent than the glamorous enchantment of the Past. For at the mouth of Green Bay my course converged to join that of the early voyageurs along by far the most important of the routes by which the interior of North America was discovered to the civilized world of two and three centuries ago.

It is a callous present-day traveler who is not sensible of his obligation to the better men who blazed the way for him in the days when the world was young. Yet it is rarely indeed that conditions are such as to make it possible adequately to visualize in the light of to-day the problems and difficulties of the path-finder



THE NORTH COAST OF LAKE MICHIGAN

of yesterday. When one stands, for instance, on the steps of the Wrigley Building or the Art Institute in Chicago and tells himself that La Salle and Joliet dragged their canoes through the swamps now replaced by steel and asphalt and concrete, somehow the picture is hard to focus to sharpness in the lens of the imagination. Nor is it possible to stand on the observation platform at El Tovar and conjure up a proper mental picture of Powell battling with the rapids in the depths of the Grand Canyon of the Colorado, nor to frame with the car window of a passing train a true vision of Lewis and Clark trying to work their boats down through the whirlpools of The Dalles and The Cascades of the Columbia.

Cities rise where the path-finder starved and thirsted, farms are spread where he cut a path through trackless forests, factories cluster at the cataracts which swamped his boats; only at a few remote mountain passes, river rapids or stretches of barren coasts where obliterating civilization has not yet encroached may the explorer of to-day put to the acid test of parallel experience the achievement of the man who blazed the trail. It had been my fortunate experience to learn thus at firsthand something of what the Grand Canyon had meant to Powell, the Columbia and the Yellowstone to Lewis and Clark, the Congo to Stanley, and the South Pacific to Captain Cook. That is to say, I had run those rivers or sailed those seas

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in craft very similar in size and type to those used by their first navigators. And now I was to be given an opportunity to learn in a similar way what the north coasts of Lakes Michigan and Huron meant to Nicolet, Marquette, and Joliet, who had pushed their pioneering way along them in craft as light and open as my own. It was to this that I referred in writing that the lure of the Present in the stirring work in hand was not more potent than the glamorous enchantment of the Past.

A dog-eared volume of Wisconsin history picked up on the hotel table in Ephraim refreshed my mind as to the progress of early exploration of the Great Lakes. Champlain, the discoverer of Ontario and Huron, never pushed west of the latter lake. To two of his associates, Etienne Brule and Jean Nicolet, was reserved the honor of carrying exploration farther up the Great Lakes. Brule turned his face toward Superior, from where he returned with a great ingot of copper as proof of the mineral wealth of the region; Nicolet headed west and south across Lake Michigan, ultimately reaching the mouth of the Fox River at the head of The Grand (now Green) Bay. Here, garbed in a green robe of Chinese silk and holding a pistol in either hand, he held pow-wow with the Winnebagos, who assured him that a few days of paddling by the rivers we now know as the Fox and the Wisconsin would take him to "The Great Waters." Mis-

taking what was undoubtedly an allusion to the Mississippi as referring to the Pacific, Nicolet, on returning to Montreal, announced the discovery of the long-sought direct route to China.

It was reserved for Joliet, the Canadian-born son of a French wagon-maker, to continue exploration on the route discovered by Nicolet and so unravel the mystery of "The Father of Waters." Setting out from New France with the avowed intention of exploring the great river of the west, Joliet reached the Straits of Michilmackinac in the fall of 1672. Wintering here, he met Père Marquette, who had established a mission for his wandering Hurons on the site of the present town of St. Ignace. The bond of confidence and affection established between the two men here resulted in a partnership that was to bring fame to both. With two birch bark canoes, paddled by Indians, the voyageurs started westward on May 17, 1673, followed the same route along the north coast of Lake Michigan originally pioneered by Nicolet and subsequently used by Nicolas Perrot in trading for furs with the Winnebagos. A month later, having followed up the Fox River from Green Bay and portaged to the Wisconsin, they reached the Mississippi. Returning by the Illinois River, they came to Lake Michigan at what is now Chicago, whence they followed the west shore of the lake to Green Bay. From here they back-tracked their original route to

Michilmackinac, where Marquette remained while Joliet pushed on to Montreal to make report of his discoveries.

The following year Marquette returned to redeem a promise to found a mission among the Illinois. After wintering on the Chicago River, he reached his destination in the spring, but in such enfeebled health that he resolved soon after to retrace his steps to die among his beloved Hurons at St. Ignatus. On this return journey he attempted to follow the eastern shore of Lake Michigan. Losing strength day by day, he died and was buried at the mouth of the river which now bears his name. Two years later a band of his devoted converts, paddling down the stormy coast in their canoes, returned with the remains of their revered leader to the mission he had founded for them, to give it to its final resting place in the chapel above the straits we now call Mackinac.

La Salle's ambitious expedition of exploration set out in the spring of 1679 in a vessel built and launched near the foot of Lake Erie. The *Griffon*, the first sailing craft to navigate the Great Lakes, reached Michilmackinac on the 27th of August, pushing on to Green Bay a few days later. Proceeding up Fox River in canoes on the journey that was ultimately to take him to the mouth of the Mississippi, La Salle ordered the *Griffon* to return to the Erie base above Niagara. In charge of a pilot, supercargo and five

sailors and laden with many bales of valuable furs bartered from the Indians, she sailed on September 18th, never to be heard of again. Tradition holds that the end came in a storm that caught her between the rocky jaws of "Death's Door," and that the Indians of the peninsula put finishing touches on the destruction started by the elements. This version of the loss of the *Griffon* lacks substantiation, but the fact remains that somewhere between Green Bay and Mackinac the first ship to sail those inland waters became also the first victim of the rocks and shoals that have since won for the north coast of Lake Michigan the grim title of "The Graveyard of the Great Lakes."

After playing its part as a strategic route in the struggle between the French and English and in the War of American Independence, the Great Lakes-Wisconsin highway to the Mississippi Valley became a channel of western pioneering movement second only to that of the Ohio. Most of the French-Canadian voyageurs who played so important a part in the early navigation of the Mississippi and Missouri came to St. Louis by this route, and the long boats used by Lewis and Clark and the Astor expedition were dubbed "mackinaws" because the men who introduced the type came by a strait and post sometimes called by that name.

With the coming of steamer navigation there was no longer necessity for the voyageur to crab along the

rocky north coast of Lake Michigan in his canoes and bateaux, while with the westerly march of the railroad there was no longer occasion to use the Fox River-Wisconsin route to the Mississippi. For upwards of three-quarters of a century now the historic highway of the earlier and later pioneers from the St. Lawrence to the Mississippi has been but a way of crumbling landmarks and fading memories. But what memories they are! Not all the savage fury of the storm that held me for four days an unwilling prisoner on St. Martin's Island could stem the rising tide of zest aroused by the adventure of trying to follow in the ways of La Salle, Joliet, Marquette and Champlain all the way to tidewater of the Atlantic.

The first two days of the storm that kept me at St. Martin's were so bad that even the big ore steamers remained in port at Escanaba, leaving the wind-whipped waters empty of movement from the shoals of Poverty Island to where they merged mistily with the Michigan mainland beyond the Bay de Noc. I divided my time between tinkering with my outfit in the shelter of the boat-house and taking long walks across and around the little island under the escort of the hardy Kincaide progeny. Not a little of the short and simple early annals of St. Martin's was revealed by our energetic explorations. Hey-day must have been contemporaneous with the height of the



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North Coast lumbering campaign, five or six decades previously. Certainly, at any rate, the deeply buried dump of green bottles in the rear of a long, square-fronted log building was of pre-Volsteadian origin. There were ruins of tiny hamlets at both the north and the south coves, and half way along the grassy road between we found what had evidently been a community church or school-house and a graveyard. The slip for boats behind the ruins of the log break-water at the north cove had long been left dry by the recession of the lake.

Where St. Martin's had supported a population of a hundred or more when it fished for the roaring lumber towns to west and north, I now found but a scant half dozen that would rate even as semipermanent residents. This was made up of the lighthouse keeper and his assistants, and a couple of men cutting cedar logs for fence-posts. All of these went home to Washington Island when ice closed navigation for the winter. There was neither telephone nor automobile, and only one team of horses. This idyllic condition may be expected to last only until the northward rolling wave of summer resorts begin to break beyond Green Bay Peninsula half a decade or so hence. The memory of the lily still unravished of its dewy freshness is filed away in a nook of its own.

Awakening to discover a clear sky overhead on the morning of my third day at St. Martin's, I prepared

to get under way again. When I went up to report to Kincaide, however, the veteran urged strongly that I delay at least another day. Pointing out that there had been no appreciable rise in the barometer, he said that the apparent falling off of wind and seas was only local, and that there was still enough of both outside to scour the hair off a cast-iron dog. If I must have a first-hand demonstration, he added, I might go along in the tender that Mallock was going to try to drive across to Washington Island and find out for myself. It was even rougher water than he liked to have the tender out in, but his report should have been on its way three days ago, and must be started to-day in any event.

Of course Kincaide was right about the weather. With two or three miles of sheltered water at either end of the ten-mile crossing to Jackson Harbor, the blast sweeping across the open stretch between stopped the dumpy, top-heavy little tender almost dead when she faced it and rolled her to her side-lights when she turned beam-on. While I solemnly assured Mallock that my own little shallop would have made better weather of the blow than his was doing, it was only by way of "saving face" after my temerity of the morning. As a matter of fact there was enough wind and wave for four miles to have swamped any sort of an open craft less sea-worthy than a double-ended whaler or a modern lifeboat.

Jackson Harbor, though perhaps the least beautiful of the several ports of Washington Island, is quite the best protected, especially for boats of light enough draught to enter the shallow inner cove. The island is the largest of the several "stepping stones" strung across the entrance of Green Bay. It has much fine woodland, with hundreds of rich acres under orchard. The population is of Icelandic origin, tempered with a mellowing blend of Scotch and Irish. They are a simple, hardy folk, having much in common with the crofters of the north coast of Scotland and the Orkneys. The men are much in demand for fishing, lumbering and sailing, but however far they fare, and however well, the loved home island is never forgotten. The home-weary Washington Islander whom I encountered so often along the lakes always recalled to my mind the lines put in the mouths of the Gaelic boatmen of the St. Lawrence:

"Fair these broad meads, these hoary woods are grand;
But we are exiles from our father's land."

My affirmative nod and grin to the eager query of, "An' did ye touch at Washin'ton?" were to prove open sesame at a score of fisher huts and logging camps on remote coves and channels of the rough north coasts of Michigan and Huron.

The tender bumped what Mallock called "The Rocky Road to Dublin" most of the way back to St.

Martin's, but without doing much harm beyond scrambling some eggs and kerosene with the parcel post package containing Esther Kincaide's new mail-order pair of hiking breeches. The eggs and oil were a total loss, of course, but Esther was quite philosophical about the breeches, saying she would be using them for cooking anyhow.

There was a hint of high wassail in the friendly invitation of the logging camp at the ruined village on the south cove to "hang on for a snack o' grub," but Mallock had to hasten back with the station mail. Trudging the leafy tunnel of the grassy track across the island, we came out to the lighthouse in the lilac scented dusk to find a fish-bake in preparation on the beach by way of a farewell party. Firm translucent steaks, cut from the sides of newly-caught lake trout and grilled on planks by the heat of oaken embers, formed the *pièce de résistance*, with various little sweets and dainties from the apple, the cherry, the currant and the maple, fabricated in the Kincaide home on Washington Island and brought over to gladden the annual lighthouse visit. For music there was a phonograph—wailing muted melody through the slats of the chicken-coop that sheltered it from the wind—supplemented by a jew's-harp and an accordion. And when these failed, we joined in lusty choruses of old songs that we all knew, with the half-remembered words clipped short on the lips of wind-

muffled mouths. What had been planned as a roaring camp-fire of driftwood was the only failure. We had to carry water from the lake to put it out after the gale began scattering the sparks a hundred yards inland to the brushy edge of the forest.

The wind was down the next morning, June 20th, but the barometer remained low, with a murky haze to the southwest indicating that the weather was still sulking and meditating mischief. Kincaide shook his head over the thinly veiled menace and consented to my pushing on only after I had promised to make the fifty-mile run to Manistique the first leg of the traverse to the Straits of Mackinac. I fell in with the idea readily enough, for while it would carry me a considerable distance from the direct course, it insured a sheltered harbor in event the weather turned bad again, as well as opportunity to get a proper forecast before heading off along the rough and almost uninhabited coast beyond.

When I got under way at eight o'clock there were only a few puffs of humid air purring languidly from the west, with almost no sea at all in the sheltered waters between the islands. The shoals surrounding the Gulls were outlined clearly in the bright sunlight, so that I was able to ignore the buoyed channel and shoot straight across on a direct east-north-easterly course to the passage between Poverty Island on the south and Summer Island on the north. Two miles

due east carried me over the shallows south of the latter island, and to a position from which I could head north-by-east to clear the out-thrust headland of Detour, on the mainland. The direct course to Mackinac from here would have taken me straight out into the lake, to pass close to Beaver Island and its satellites and on to the Straits by the regular north-and-south steamer track. With this course carrying me thirty to forty miles from land at points, I had never seriously considered taking it at any time since discovering that the Great Lakes were not always as smooth in real life as upon the map. The old point-to-point (and even cove-to-cove in emergency) course of the early voyageurs was quite good enough for me along the north coast of Lake Michigan. Or at least that was the way I felt about it the morning I resumed my voyage from St. Martin's. That four days' close-up of the ways of a wind with soft green water had not been without its chastening effect.

It was a beautiful run as far as Point Detour, the only fly in the ointment coming in the rather too literal form of a cloud of gnats, apparently carried lakeward from the mainland on the warm morning breeze. Although without the mosquito's lust for human blood, they were still highly annoying in their delight in wallowing in the pungent anti-insect dope with which I had anointed all exposed cuticle for the purpose of scaring them away.

I had been smearing off gnats with a case-knife blade for half an hour when I became aware of a heavy whistling roar, hurtling through the humid air from the south-west. A hundred times heavier than the deepest-toned steamer whistle, the weird sound set the atmosphere throbbing as from the rumble of a distant cataract. It was the regularity of the roars that revealed their identity, and I remembered the huge boilers in the brick structure beside the St. Martin's lighthouse tower, with the scores on scores of cords of wood stacked up to feed into the capacious maws of their fire-boxes as emergency arose. So clear was the air in my immediate vicinity that I had almost persuaded myself that Dave Kincaide was limbering up his giant fog-horn only for practice, when a solid wall of vapor rolled into the lake, blotting out Poverty and Summer Islands with a gray-white shroud of opacity as it came. Five minutes later the vanguard of the fog was rushing past me, quenching the gold of the streaming sunlight and leaving the motor spattering mist-muffled pops in the heart of an inverted bowl of dripping, sodden grayness.

Taking hurried bearings before the last of the mainland was masked by the scurrying fog-banks, I made out my position as almost abreast of Point Detour, distant about a mile. Ahead, as shown by the chart, was a coast-line scalloped by shallowly indented

bays and running on in a general north-easterly direction to the mouth of the Manistique River, for which I was heading. There were two possible dangers to be avoided, neither by any means negligible. One was that of heading too far lakeward and so being caught out of reach of land if the lurking disturbance off to the south moved up the lake again; the other was that incident to getting off the course in the opposite direction and bumping into shoals. Anxious to know just what to expect in the latter line, I shut off the motor and let the boat drift while I turned up a paragraph in the "Survey" headed "Between Point aux Barques and Point Detour." The whole was in the nature of a warning to give wide berth to a stretch of coast which appeared to be as thickly fringed with reef and shoal as a South Sea atoll. One passage, referring to points which the chart showed to be only a few miles ahead, was distinctly disturbing. This read as follows:

"Between Parent Bay and Portage Bay the coast is filled by rocks and shoals with very little water on them, the maximum extent being at the north-east point of Portage Bay, where a spit that is nearly exposed in places reaches 2 miles to the south-east."

Between the certainty of hitting a reef and the chances of getting lost in the fog with plenty of water under the keel, I unhesitatingly plumped in favor of

sea-room as against the rocks. Starting the motor again, I took out my pocket compass and laid a course for the open lake. Or rather, I laid a course which I *thought* would take me to the open lake. It was probably the fact that I set the compass (normally a fairly good little instrument of its kind) too near the head of the mushroom anchor to give it a fair chance to function that was responsible for the fact that I headed in quite the opposite direction.

The fog was so dense that not over twenty feet of gray-green water showed inside of the mist-curtain ahead, and with no light striking through from above the depths were as dully translucent as the surface of ground glass. The smooth, rounded rock that stopped us seemed to come bounding up through fog and water like a diving seal. It was fortunate that the engine was throttled down to the last notch; also that the blow was received and absorbed by the stout oaken forefoot before the propeller grounded. Both the motor and myself tilted automatically at the impact, and of the two my own recovery was the quicker. Bouncing back from the spring-steel hoop of the spray-hood against which my surprised anatomy had been flung, I regained the stern of the boat in time to shut off the engine almost as soon as the half-uncovered propeller began to race. That allowed the bows to slide back into the water from the sloping side of the rock and gave me a chance to collect my

wits and my cargo. With practically no sea at all running, it was possible to proceed with both operations without haste.

Built to withstand just such a collision, damage to the boat was hardly more than paint-deep. Everything loose had been carried ahead by its momentum, but the closest survey of the forward compartment failed to reveal the first sign of a starting leak. Retrimming my load and truing up the spray-hood crushed down under my weight was the matter of but a few minutes. All snug again, I looked about, to discover, through a momentarily lifted flap of the fog-curtain, that I was drifting within a hundred feet of rocky beach closely backed by a thick wall of forest. Black turtle-backed rocks, like the one with which I had collided, carpeted the floor of the cove on all sides, most of them just under the surface of the water. In a shallow pool on a limestone shelf a stranded fish flapped weakly, jealously watched by a pair of gulls and a lone kingfisher. Where the waters of a little spring tumbled down the rocks a bevy of robins shivered, as though waiting for the sun before taking their morning baths. From a birch at the edge of the woods came the clear, sweet notes of a thrush, a challenge to the fog that might dampen plumage but could not quench the fire of inward ardor.

It was a wonderfully snug little haven to have remained in for the lifting of the fog, but the quietness of the air and water finally decided me in favor of saving what time I could by feeling my way along up the coast at reduced speed. Pulling out where the water seemed to deepen again, I headed away under throttled motor in an endeavor to parallel the shore as closely as possible without completely losing touch with it. A sharp watch prevented another collision, but the shifting fog made the shore-line as elusive as a will-o'-the-wisp. The fact that it seemed to be winding round and round on itself in narrowing circles like the spiral of a snail's shell was doubtless an illusion fostered by the necessity of turning constantly to port to regain touch with the fugitive blue-black blur which betokened land. Progress was painfully slow, and it was with real relief that a sudden shower of golden glimmers through the mists marked the passing of my first and my last Great Lakes fog.

The fog, which had sponged the clinging humidity out of the air in its passing, seemed also to have left the prospects of better weather in its wake. There was brilliantly clear sky overhead, while the bank of muddy murk to the south-west had receded and paled to a less menacing somber gray. The brisk southerly wind was keen and bracing—snappy with ozone.

Running out a couple of miles, I headed up for Manistique, still obscured by the rolling fog-bank to the north. Helped materially by the freshening wind, I bowled along at a lively rate until a horizontal ruffle of foam ahead charted the long thin reef thrust out, poniard-like, from the tip of Wiggins Point, four miles north of Point aux Barques. Running in until the dervish-dance of golden light-motes warned of a shoaling bottom, I shut off the engine and drove on through the flashing foam-flecked combers under oars. This was a half-mile inside the red gas and bell buoy marking the channel beyond the end of the shoal, but there was plenty of water all the way across for my few inches of draught. Three or four uncovered rocks bared warning fangs at me as the boat was swept by, but the thicker welter of white revealed their positions well in advance and it was not hard to avoid solid contact. In a storm, between uncovered rocks and heavily breaking waves, it might have been hard to avoid foundering here; with the light wind and seas I had it was about like running a fairly rough rapid with an unusual amount of time to pick a course. It could probably have been managed with the engine, but the few minutes to be saved by running under power were not worth taking the chance of disabling my capable little kicker.

With the sun mopping up the last of the fog ahead the smoke-clouds above the mills of Manistique began

rearing their inverted spirals against the sky, a dark slaty blur at water level revealing the easterly curve of the coast where it looped round to Seul Choix Point, with its white finger of lighthouse tower pricking the haze just forward of the starboard beam. With Seul Choix directly on my course to Mackinac, and with Manistique many miles off, there was strong temptation to save time by running direct for the lighthouse station on the historic point. A sudden freshening of the wind conspired with Kincaide's warning about not passing Manistique without getting a weather forecast to hold me to my original course. Consoling myself with the thought that there would still be time to push on to Seul Choix before dark anyhow, I laid a course for the lighthouse on the ends of the harbor breakwater and drove ahead before the now sharply blowing south-east wind. Until I was within half a mile of the entrance the following wind and waves were a real help, giving the boat all of a knot and half extra speed. Then the seas began to shorten and steepen in a way not entirely to be accounted for by the shoaling water, and which I learned later was due to the current of the river meeting the rising tide blown in from the lake by the wind. Between the ends of the piers at the entrance the waves were actually combing over and breaking in the middle of the 18-foot channel, so that the boat shipped much solid green water as she yawed to port and

starboard, while the outraged Elto coughed indignant protest at by far the worst drenching it had yet received.

The performance must have looked a good deal worse to a spectator than it seemed to a participant. Two boys, fishing on the east pier of the breakwater, dropped their poles and ran into the tower of the lighthouse to call the keeper. Roused from his sleep, that worthy gave one look from the door through blinking eyes and began bawling through his megaphone for a launch to put off from the fish-docks a quarter-mile up harbor. Then he dashed down the steps, jumped into his skiff and started to push off on a rescue party of his own. The fact that I missed few if any of the details of his frantic efforts to keep from falling overboard when the boat came to the end of the painter he had neglected to cast off is the best evidence that I was not in serious straits myself. A sharp turn to starboard a hundred yards inside the entrance took me into quiet water in the lee of the curving east pier.

Approaching the picturesque row of fish docks along the east bank of the river, I was confronted with the phenomenon of a rapid in-running current where I had expected a set in quite the opposite direction. One of a number of fishermen busily engaged in taking in the slack of the mooring lines of their

boats paused a moment to explain what was wrong. Heavy southerly winds, he said, had the effect of shoving ahead a body of water which acted like an ocean tide all along the north coast of the lake. The water of the Manistique River had already been backed up to a rise of over a foot at the docks and two or three feet more might be added before dark. The responsible wind, he added, was not the one which had been driving me along after the rising of the fog. That was only a stiff breeze. The force behind the making tide was a sustained blow which had probably been driving up the middle of the lake since early in the day. The worst of it might never reach the north shore at all, but just the same it wasn't a thing to take any chances with. All the fishing boats had already come back to port and none was going out. I might, of course, make Seul Choix Point lighthouse before the weather got too bad; and again I might not. As the intervening coast had not been designed to make forced landings easy, especially with only one man to the boat, he was inclined to recommend that I should lay up in Manistique for the night and see how the weather developed.

This sounded like reasonable advice, and I was all the more ready to follow it when I found that a large launch belonging to a fishing outfit just west of Seul Choix Point had postponed until the morning a de-

parture announced for four that afternoon. The skipper of this launch (whom I presently learned was a member of the French-Canadian family of Goodreaus, well known all along the north shores of Michigan and Huron as pioneer lumbermen, sailors and fishermen) very kindly offered me a berth alongside, with a place in his cabin to spread my bed for the night. He also suggested that I put in to his little natural harbor near Seul Choix Point and pay him a visit. We could make the run in company the following morning if the weather was favorable.

My thoroughly earnest efforts to secure the latest official weather forecast before leaving Manistique met with no success. The Coast Guard stations were along the main steamer track, now on the opposite side of the lake from that I was following. The latest bulletin at the post office was thirty-six hours old, with the weather it forecast already a matter of past history. Rumor had it that a local radio operator received weather data, but him I was unable to locate either at his office or home.

Returning to the Goodreau launch, *Garwask*, to sleep for the night, I found the Captain had come down from his home in the town to tell me that he had just had word of a raft of net-piling that was to be ready for him to take in tow for Seul Choix the next



THE END OF A STORM ON LAKE MICHIGAN

morning. As he would be delayed in getting away, with his progress very slow at best, he thought it would be preferable for me to start at daybreak so as to take advantage of the lighter airs usually prevailing earlier in the day. He still hoped I would lay over a day for a visit with him.

With the strange wind-driven tide lip-lapping higher and higher against the crumbling logs of the river-wall, and with inky masses of flying clouds alternately obliterating and revealing starry patches of the purple vault overhead, I kept the pioneer long into the night, drawing him with ready interest from yarn to yarn of his colorful years of hunting, fishing, trapping and lumbering in the times when (to use his own expression) there were men and trees with the bark on all over the Michigan peninsula. It was fortunate that I banked that gold of human experience while I had a chance. Neither the *Gawask* nor her skipper ever caught up with me, and subsequently, in St. Ignace, there was a report that both had taken the count in a bout with a mad maverick of a storm which the crafty Great Lakes Thunder God must have been extracting from his capacious bag of weather tricks even while the sturdy old pioneer drummed heels on the side of his deck-house and entertained an effete but kindred soul with tales of the days when trees die with their barks on and men with

their boots, and nothing less than an ax would kill either one or the other.¹

¹ Up to the time of writing I have never been able definitely to verify the report of the loss of the *Gawask* and Captain Goodreau. The latter's brother, whom I met in Mackinac a weeks after my departure from Manistique, had heard the report current among the fishermen but was inclined to doubt it. Letters of inquiry, sent to both Manistique and Mackinac, have been returned to me. Until I hear definitely to the contrary, however, I shall continue to hope that the sturdy launch aboard which I slept so snugly my night in Manistique is not included in the list of twenty-four craft reported by the Coast Guard service to have been lost in last year's storms on the Great Lakes, and that the name of her rugged skipper is not on the roll of the several score sailors paying the supreme penalty during the same period. (L. R. F.)

CHAPTER V

LAKE MICHIGAN SHOWS ITS TEETH

Save for a few spitefully spitting rain squalls which kept me under the grateful shelter of the *Gawask's* cabin, the expected southerly blow failed to materialize. There was a clear indigo vault of sky overhead when I rolled out a half hour before daybreak, with a spatter of stars that paled from glittering gold at the zenith, through orange and lemon to faded olive where they merged into the spreading arc of brightness sitting like a halo on the brow of the coming day.

Of all the dawns I ever watched that one stole earthward on softest foot. From the black velvet of full night the heavens faded through the furry brown of the bat's wing to the dun-gray of fawn, before melting into a flood of fluttering light that rippled like a scarf of amber silk stirred by the breeze. Even on the face of the sun itself there was more of a glow than a glitter, rather the satiny sheen of the saffron poppy than the shimmer of polished gold. The young orb of day radiated sweetness and light rather than pomp and circumstance; benignity rather than power. He was essentially the herald of a day of fair promise; or at least that was the way it struck me at the time.

It was the magic of the morning working on my prideful consciousness of the feat of having made nearly fifty miles the previous day in but little over six hours that struck fire to smoldering ambition. With the Straits of Mackinac distant less than eighty miles by the dotted lines on the chart, what could be simpler than making the distance at a single jump? Twelve hours of steady running at seven miles to the hour would turn the trick with some to spare provided the promise of the morning was fulfilled; and by every sign I knew the weather was going to be fair for twice twelve hours. When a glance at the chart revealed that the steamer track would take me out of sight of the mainland for a good many miles beyond Scott's Point, I remembered the warnings of all my good friends of the Coast Guard and decided not to take the chance. I would hug the shore closely as advised, but would run until dark just the same and put up a real day's record to my credit. With fifteen or sixteen hours of the finest day of the summer anywhere from a hundred to a hundred and twenty miles ought easily to be reeled off, and playing safe all the time. Oh, yes, I was going to lean over backwards on the safety score. And that was the way the day began.

Anxious not to lose time by going up town and waiting for a restaurant to open, I decided to have recourse to my own galleyette, hitherto unused. Putting a can of water to boil on my "canned heat" stove,

I cast off moorings and drifted down to the harbor entrance with the current. The wind-blown tide of the previous night had been receding for some hours, and the channel between the outer piers was barely rippled by the light westerly breeze of which I now became aware for the first time. Pulling out a quarter of a mile to where the lake became bright and clear, I poured a couple of buckets of water over my back by way of a morning shower, breakfasted on eggs, bacon and steaming hot cocoa and was ready for the day's work.

Congratulating myself on the luck of having a following wind again, I started the engine, laid an east-by-south course to clear Seul Choix Point and settled back to bask in the gladness of the morning. The chart showed barely submerged reefs to port and starboard five miles from the entrance, but with the sounding plummets of the slanting sunlight striking down through the clear water they were outlined as sharply beneath the surface of the lake as upon the map.

When a dying pop from the motor signaled an empty tank I was almost abreast of Seul Choix Point, indicating a run of nearly sixteen miles for the first gallon of gasoline. I was sorry to pass the lighthouse without landing for a friendly word, but the temptation to take advantage of the fair wind and smooth sea to reel off my initial century run was too

100 BY WATERWAYS TO GOTHAM

strong. A long narrow spit of rocks running out from the point proved too shallow to cross with the propeller down, so I tilted the motor and picked a way through under oars. The momentary slowing down was more than compensated for by the saving in distance.

Beyond Seul Choix Point the coast dipped back to the north for several miles before turning easterly again to Hughes Point. The direct course to Mackinac continued on east-by-south. When the chart disclosed that I could hold this course for another ten miles without being over four miles from land when abreast Point Patterson, where the big dip to the north began, I took the chance without a misgiving. This would take me well outside of a very reefy bit of coast and still leave me in a favorable position to edge shoreward if there was the least sign of unfavorable weather. I wasn't going to take any chances with Great Lakes weather, I told myself; not I. I was going to play good and safe even if I didn't reach Mackinac for a week. That was the way the voyageurs had done the thing, and their way was good enough for me.

It was eight o'clock when I got under way again beyond Seul Choix Point. The wind had freshened perceptibly but was still light. That there was a sort of buoyant gush to it (as though suggesting plenty more air where this came from), was all a part of the

gladness of the morning. I even remembered hoping that it would strengthen a bit, so as to push me along faster; also that it would haul a point or two more southerly and give a slant that would blow the exhaust fumes off to leeward without lapping me in their soporific embraces. And when the wind obliged with both of these desiderata presently, I told myself that this was my lucky day—that things were surely coming my way at long last. And so they were—and in bountiful measure.

A smart run of an hour and a half carried me abreast Scott's Point, distant about four miles due north. A place marked as Orrville on the chart appeared through my glasses only as a group of ancient log houses, probably the remains of an old lumbering village. To the south and south-east several units of "The Beavers" notched the horizon, the cliffy profile of High Island rearing a blank silhouette against the broader but lower blur of the member giving its name to the group. I was looking across to the one-time domain of "King" Strang, and with regret that I had to pass it by.

James Jesse Strang, formerly a young New York lawyer, joined the Mormon Church at Nauvoo, Illinois, in 1843, but a few days before the assassination of Joseph Smith at the hands of a mob. Promptly digging up some copper plates from a convenient hillside, Strang announced that they were the long-

sought-for missing passages of the Book of Mormon and that he, by their finding, was designated as the new leader of the Latter Day Saints. Most of the Saints rallied around Brigham Young, who led them West to found a New Canaan in Utah. Those faithful to Strang he shepherded north to the picturesque and fertile Beaver Island, where the leader built a tabernacle and proclaimed himself a king as well as an apostle of the Lord. The despotism of his rule, increasing year by year for a decade, reached a climax with an edict ordering every woman of his kingdom to wear pants, and pants, moreover, of a design approved by His Royal Highness Himself.

Strang could not have been a student of history, else he would have known that he was attempting the sort of thing that had started paradises and kingdoms falling from the time of Adam. The sartorial edict was the beginning of the end. The Mormon ladies fell in step; their Gentile sistern, of whom there were a few on the island, demurred—refused to step-in, so to speak, if the anachronism will be permitted. The recalcitrants, following another royal edict, were panted by force while protesting husbands and brothers were whipped. Both panting and whipping were carried out publicly, and to the accompaniment of appropriate religious rites. Among the Gentiles smarting, both mentally and physically, from the humiliation, was a man named Bedford, who had come in for

a particularly brutal beating as a sequel to defending the right of his wife to choose her own clothes. Mrs. Bedford wept shame tears for days and days, according to the chronicles of the time, but her eminently practical husband took elaborate care that none of the salty drops should fall on the priming of his trusty powder-and-ball horse pistol. One day when a Royal Progress toward Mackinac was about to begin, there was a roar from behind a pile of cordwood near the steamer dock, and King Strang bit the sawdust, pierced by a bullet which shortly brought his life and dynasty to an end. Bedford, welcomed on the mainland as the overthrower of a tyrant, returned as the leader of a Gentile band that soon scattered the remnants of the late King's subjects to the four winds of the Great Lakes.

When I stopped to refill the tank of the motor for the second time it was nine o'clock, and I had reached a definite parting of the ways—a point at which final decision as to my course for the rest of the day must be made. The course to the Straits of Mackinac was a point or two south of east, straight out into open water and right down the middle of the narrowing lake. For thirty or forty miles "The Beavers" would be my nearest land, and when they were left astern I should be running nearer the south coast of the lake than the north. The way back toward the north shore and the track of the voyageurs was on a

course anywhere between north and east-north-east.

Even that benign vault of cloudless cobalt and the kindly breeze with its extra mile or more an hour of push would not have been enough to lure me out onto the great stretch of open waters, especially in the face of all the warnings I had received against attempting just that sort of a traverse, had not the chart and the U. S. Army "Survey Bulletin" joined the conspiracy at this critical juncture. With the colored reef contours of the great bight to the north giving the chart the appearance of the face of a pernicious smallpox victim in the last stages, and with the "Survey" describing the coast for miles beyond Point Patterson as "filled with an extensive flat which, at about the middle of this stretch, extends out a distance of nearly $2\frac{3}{4}$ miles," I was not loath to take advantage of the fine weather to follow an outer course which would not only save distance but also carry me far beyond the zone of dangerous shoals. I really thought I was taking the safest as well as the shortest course. Where my reasoning slipped up was in failing to take account of the altogether baffling assortment of tricks in the Great Lakes Weather Bag.

Just to be on the safe side, I decided at the last moment to lay a course passing north of Lansing Shoals, with their light-ship, and head a bit north of east to come back to the mainland off Point aux Chenes, thus shortening the open water traverse to less



SOME LAKE TROUT

than forty miles. The rest of the way to St. Ignace I would hug the coast and take advantage of the lee of the island of St. Helena for shelter in case the wind got up in the afternoon. Nothing like playing safe with an open boat!

The first hour was glorious. The clear waters of the lake, green as emerald overside, were a shimmer of opaline brocade to sunward and a hard slab of furrowed indigo to the north. The sunshine was a smile of joy, the breeze a gay gush of gladness. Highly pleased with myself, the day and the world in general, I lounged at indolent ease in the life-preserver-upholstered stern and watched the forest wall that marked the low northern coast fade through sage and olive green, to disappear from sight in a blur of slaty-purple. "The Beavers" still marched to the southward, now in single file along the horizon, now two or three abreast as when my progress superimposed the silhouette of Squaw Island against that of Whisky, with the skyline back of both blotted out by the loftily looming High Island.

With the mainland sunk beyond eye sweep, nothing save "The Beavers" broke the open expanses of water stretching to flat horizon in every direction. What a picturesque group they were, I reflected; and what a picturesque history had been theirs! Perhaps nothing could give better illustration of the day's apparent emptiness of menace than the fact that my most seri-

ous care of the moment had to do with pondering the picturesqueness of the skyline—historical and physical—of “The Beavers.” I never got very far, though. I was just telling myself that there must be a moral to the story of “The Rise and Fall of King Strang,” when the rise and fall of something much nearer at hand put a period to incipient philosophizings. This was the surface of the lake, and a small fragment of it that fractured on the weather gunwale and spattered down my neck was the immediate instrument by which it called attention to a restlessness which had doubtless been increasing for some little time.

It was the very open-and-above-boardedness of what now began to have the ear-marks of a strong south-westerly blow that had enabled it to steal upon me almost unobserved and quite unsuspected. If there had been fluky airs and banks of nimbus frowning a saturnine threat from even the distant horizon I would never have seriously considered getting far from land, and certainly not out of sight of it. But with that steady milk-warm breeze and a clear sky I had ventured forth lightsomely, with a mind so free of apprehension that it found nothing more serious to do than trying to hunt for a mustard-seed of moral in the haystack of King Strang’s history. That cold douche of flipped wave-crest brought a mental as well as a physical shock, awakening me to a full realization of the distinctly disturbing fact that the boat was

beginning to wallow in a sea of near-white-caps, driven before a wind which the briefest of calculations proved to have been augmenting force at the rate of something like five miles an hour since daybreak. It was that steady, relentless making of the wind that gave one furiously to think. I had already chugged jauntily enough through seas much heavier than those of the moment, or even any that were likely to be running inside of the next hour. It was how things would be still later that was the problem, considered, that is, in the light of the fact that the nearest stretch of coast could hardly be less than three hours' steady running to the north. But it was the character rather than the length of that run which gave me pause and induced renewed resolve to fight it out with the wind and waves in open water rather than to face the blind gauntlet of the hidden dangers lurking among the almost unbroken shoal barriers to the north.

That high Hamletian resolve to bear the ills I had rather than fly to those I knew not of began to bend as the rising seas broke out their snowy pennants all the way to the southern horizon, to snap short when a walloping comber broke inboard over the starboard quarter and left an inch of water slushing in the bottom of the boat. The wind was continuing to haul southerly, with the seas following. As long as I held my original easterly course this brought both nearly

abeam, making steering wild and erratic as the wind billowed the spray-hood and exposed the low weather gunwale to the full force of the mounting seas. Turning north and running dead before the wind minimized the trouble from both scores, and for the moment the boat made fairly comfortable weather of it. That eight point alteration of course, however, signaled the end of the high resolve anent slashing through on the outside in open water.

Just as soon as it became evident that there was no practicable alternative to heading in across the shoals I did a sensible thing, or rather two or three of them—quite the only sensible things, in fact, that I can candidly credit to myself between that time and when I pushed off at daybreak. Shutting off the engine I refilled the gasoline tank. Between the wind and the lurching of the boat this was far from a simple task, and the amount of gas lost suggested that it would be a wise precaution to get out and have ready against the next filling the special can and hose devised by Ole Evinrude for use in just such an emergency. The can, fortunately, proved to be already full.

Lowering the readily adjustable spring-steel arch of the spray-hood and taking up the slack reduced materially the area of canvas exposed to the force of the wind, promising to mitigate an already troublesome tendency of the boat to yaw drunkenly and

heave the lee rail under in the rolls. The bending of the end of a hundred-foot line to the handle of my collapsible canvas bucket left me with what I was confident would prove a fairly useful sea-anchor in case of need. I knew that it would perform its function better if there was a hole in the bottom of the bucket to allow the passage of a current of water, but refrained from cutting this save as a last resort in order to have the handy little rope-bound canvas bag available for bailing.

As a final precautionary touch, I slipped into and tied on securely my old kapok life-preserver, still bearing the red mud stains of the Colorado. I needed some further protection against the flying spray anyhow, and the soft, flexible sleeveless jacket was as warm as a coat and much easier to work in; moreover, the reassuring pressure of the faithful old friend—it had brought me back from the bottom of the Grand Canyon after my upset in Separation Rapids the previous October—furnished just the sort of an unobtrusive bolster that my somewhat wobbly confidence stood so much in need of at the moment.

Anticipating that conditions might presently develop which would make difficult if not impossible further consultation of chart and "Survey," I deferred starting the motor a few minutes longer in order to get a rough idea of my position. Bearings on Hog and Garden Islands of "The Beavers," with a hasty

bit of mental dead-reckoning, put me twenty miles off the north shore of the bight and about due south of Biddle Point. With the whole landward area of the chart peppered with reefs until it looked like the target pattern of a choke-bore shotgun, uncomfortably shoal water was certain to be encountered in whatever direction I slanted shoreward. Most of this would mean only shorter and steeper seas, but soundings of two and three feet over Fagan and Pelkie Reefs a point or two to starboard, and even shallower depths among the Mille Coquins and the Naubinway Reefs, almost on a direct line to the nearest land, meant heavily breaking seas and possibly uncovered rocks.

There were two reasons why it would have been futile to attempt to lay a course calculated to avoid the most menacing of these shoals. One was that I was not sure enough of my own position to reckon where they bore; the other that, having to run dead before the blow willy-nilly, my course would have to be a matter of the wind's will rather than of my own. The best I could do seemed to be to try to get some sort of a line on what the wind had in mind, and to this end a very meticulously stated formula in the Year Book of the Lake Michigan Yachting Association promised to be of help. It was called "a very accurate rule for determining the direction from you of a well-developed storm-center," and read as follows:

“With your back squarely to the wind, extend your right arm horizontally in front of you, pointing with the wind, and your left arm straight out from your side at right angles with the other; the direction of the storm-center will be usually half way between your two hands, or, say, about four points off the wind; in some cases, only one or two, in other cases six or seven points. . . . As the storm passes by, the wind on the south side of it will swing by way of the west to the north-west or north; on the north side it will back by way of the east to the north-west or north.”

Now this all-embracing method of tracking the fugitive storm-center to its lair by means of the extended arms may be perfectly feasible to put into practice on the comparatively stable-minded deck of a staunch forty-footer, but I shall never be convinced that the men who framed it ever tried it out from the bottom of a wind- and wave-buffed open skiff. I managed to teeter to a precarious balance, and even to extend my arms at the prescribed semaphoric angles; but before adequate orientation indicated the direction of the lurking storm-center the boat toppled over the crest of a hollow-faced wave and the fact that I jack-knifed across the spray-hood instead of the lee gunwale was due entirely to the fortunate line of impulse. Crawling back to a sitting position, I resorted to the alternative method of locating the storm-center by reckoning “points off the wind.” Turning my head back and forth through a narrowing arc until

its nose pointed dead into the eye of the gruffening gale, the rest was easy. The storm-center was, "say, about four points off the wind; in some cases only one or two, in other cases six or seven points." Even an apprehensiveness that was mounting with the rising wind could not cheat me out of a chuckle anent the "very accurate rule" that gave the storm-center from one to seven points leeway.

I was able to garner one rather significant fact from the paragraph, however. This was that, when one was on the north of the storm-center, a wind from the south might be expected to back rapidly through the east until it was coming from quite the opposite direction from which it started. As this seemed to indicate that I might shortly be assailed by an off-shore wind ambitious to blow me back into the open lake, there was no question in my mind that no time should be lost in heading back toward land before opposition set in.

With wind and waves adding two or three knots of kick to that of the motor, I made wonderful headway for a while—probably better than a rate of ten miles an hour. Then, with white streakings of foam beginning to lace the clear water between the curling wave-crests as the wind shouldered them on with increasing force, the yawings of the boat became more and more troublesome. As long as she ran dead before wind and wave little water was taken, but when

she was swung to port or starboard as a hump-backed sea tumbled along beneath her keel solid green water was dipped by whichever was the weather quarter. As long as I could devote both hands to the tiller lines and meet a swing as it got under way, steering was not so erratic. But when I had to try to tool the reins with one hand so as to leave the other free for the bailing bucket, my quickly quenched wake began to take on more and more the seeming of the track of a seismographic needle at the height of an earthquake shock. This cut down speed materially even before the plungings of the boat became violent enough to bring the stern out of water and start the screw racing.

With my main flocks of fears clustered about such nucleii of menace as half submerged shoals and the surf through which my ultimate landing must inevitably be made, I had failed to reckon with a more imminent threat which presently began to develop as a very real one. This was the danger of broaching-to and being caught broadside and upset. That possibility was suddenly driven home to me when, at the end of a wild swooping yaw to starboard, a sharp nose-dive flung the propeller out of solid water and left me fanning empty air with an impotent rudder. A half second later the accelerated screw had bitten into green water again and restored steering way, but the instant of hesitation was just long enough to ex-

pose the boat to a broadside blow from a rollicking comber that broke against her from bow to stern. She had yawed so far round that the worst of the impact was taken and deflected by the spray-hood. Although water that was far from being blown spray came right across my knees, that inundation—quite the heaviest I had sustained so far—was by no means the most serious phase of the incident. This was rather the fact that the boat all but capsized to port in teetering up the breaking front of the wave, and then rolled over just as far to starboard in tumbling off the back of it. Taken quite by surprise, I had no chance to counterbalance the rolls by throwing my weight against them; in fact, I felt that I was doing rather well in not being flung entirely out of the boat. Momentarily helpless and adrift, my abused anatomy only added that much more shifting weight to slushing bilge water and tumbling cargo to decrease the precarious margin of stability.

It took a hard two-handed pull on the port tiller line to hold the rudder over when the resubmerged propeller restored steerage-way, but the boat came up smartly if staggeringly to present a buoyant stern to the next assault. Followed a rather madly mixed interval of feverish and somewhat futile activity, filled largely with poignant regrets over the fact that inadequate evolutionary progress had denied me the octopus arms so urgently demanded for the some half

dozen important things that needed doing at once. Outstandingly imperative was an improvement of steering technique that would reduce the chances of broaching-to and being dealt another broadside by a charging sea. This proved to hinge very largely upon keeping a sharp eye on the wolf-pack of waves pressing up from astern, divining just how and where each in its turn was going to snap or shoulder as it closed in and disposing my two hundred and thirty pounds of live ballast so as to make for the best defensive trim, thus giving the rudder a chance to function under more favorable conditions. It was nothing more or less than applying the basic strategy of war or football, that of outguessing the other fellow.

Balancing against the rolls came naturally and easily; sliding quickly forward to keep the stern from burying itself, or leaning aft to keep the crew kicking in solid water, required more of a mainspring of mental reaction. The ganglionic nerve centers back of reflex action are apt pupils, however, so that I presently had my human gyroscope furnishing a crude but highly helpful fore-and-aft corrective while hands and mind were engaged with other tasks and problems. For a while at least, steering efficiency mounted faster than the force of wind and seas.

With improved control of the boat there was a chance to shift a hand now and then to the bailing bucket and gradually to reduce the very considerable

accumulation of water swirling mid-ankle deep about the bottom. She rode perceptibly higher and steadier after being relieved of the most of this shifting ballast, and for some little time an occasional hasty dab and toss with the bucket took care of all the dippings and sloppings that came aboard.

Encouraging as it was to know that we were doing distinctly better for the moment, I did not let my rising tide of confidence blind me to the fact that the real test would not come until we ran in among the shoals, and that even if trouble was avoided here there would still be the problem of filling an emptied tank while drifting without steerage-way; and after that would come the landing through the surf on what was almost certain to be a rocky shore. Heartening as it was, then, to find boat and engine performing so well under the most arduous conditions they had yet faced, there was still enough threat in the little diversions lurking in the Unknown beyond the gray smother ahead to keep the Bird of Optimism from leaving his wet perch and soaring up to lose himself in the blue empyrean that still vaulted the stormy waters below.

Matching wits with the pressing wave-pack and trying to meet every lunge with a parry was rather good sport in a way, especially while I was getting a shade the better of the decision. The worst of it was that the contest demanded the practically undivided at-

tention of my eyes. I could balance and bail without uncovering, but at every attempt to steal a glance ahead the enemy thrust home under my guard with telling effect. Trying to peek at the chart was still more costly, and I gave it up after the first attempt nearly resulted in another broaching-to. The shoaling comber which broke over into my lap on this occasion also slammed the half unrolled chart, a sodden mass of pulped paper, into the water beneath my feet, and just at the moment my interest had been rather more than a little intrigued by a calculation which seemed to prove that the extensive Mille Coquins Outer Reef was directly in my path. I was just dabbing about the blue-blotched picture of the shallows with a greasy fore-finger when the cataclysm descended, and by the time I had contrived to put the worst of the displaced hunk of lake surface back where it came from by means of the bailing bucket most of the chart had dissolved and gone with it. The loss really didn't matter a lot, however, for it was only a question of minutes until navigation was reduced to the primitive first principles of keeping afloat and going the way of the wind and the waves. Under the circumstances, therefore, scientific navigational refinements like the chart and the compass were strictly in the class of frills.

My somewhat sketchy mental picture of the chart of the Mille Coquins showed the outer and inner reefs

as practically continuous and covering an area of several square miles. The shallows were marked with soundings of from three to twenty feet, with considerable spaces of from five to eighteen fathoms between. On a quiet day there would probably have been nothing shallow enough to strike, and even in moderately rough weather there would have been a chance to pick a course by the deeper channels. With the present blow, however, where any course but one dead before the wind would have meant instant swamping, there was nothing to do but barge ahead and trust to my engine and the

“Sweet little cherub that sits up aloft
To keep watch o’er the life of poor Jack.”

In this particular case I was more inclined to bank on terrestrial service than on celestial intervention. For one reason, I was not at all sure that the sweet little cherub had ever extended his salvage service to include fresh-water sailors. Again, even if he did not draw the salinity line, there was a sort of dim consciousness of having already sounded the cherubian “S.O.S.” on the three occasions which are supposed to be the limit beyond which his aid may no longer be evoked with any assurance of response. On the other hand, I knew perfectly well that the only cherub that could be of any use in the event of engine failure would have to come in the form of a Coast Guard cut-

ter or a lumping big fishing launch, and not the slenderest sliver of a craft of any kind had been in sight since daybreak. Of course, since spectacular last-minute rescue work was the celestial wight's specialty, it was all very well to keep him hovering in the offing as a *dernier resort*; but in the meantime "Trust in the cherub but keep your engine going," struck me as being a very practical sort of working maxim for "poor Jack" to pin his faith to.

With wind and sea continuing to rise, I still managed to maintain a fair margin of safety by bending every effort to trimming the boat and more effective steering. In fact, the opening round was somewhat in my favor, in that there was a bit less bailing to do during the second half hour than in the first. Indeed, had it been a limited round contest rather than a fight to the finish—had there been a sheltered harbor a mile or two to leeward, for instance, with deep water in between and nothing but the wind and the waves to contend with—the give-and-take of the bout would have been real sport. It was the uncertainty about the "worse-to-come" in the reefs and the final landing that robbed the play of its zest—except in retrospect.

The first forerunning signs of shoaling water in the form of shortening, steepening seas became manifest so gradually that, for a few minutes, I was inclined to attribute them only to a more rapid augmentation in the force of the wind. A foot or two more of

foam at the hissing crests, with an increasing tendency to curl over and break, gave me the first hint that the bottom was rising and, by retarding the base of a wave, causing it to topple forward as a man trips and stumbles over a step in the dark. They were still far from being fully combing breakers, else the boat would not have continued to ride them; but the breaking tendency of their high rearing crests made it a deal easier to penetrate my defenses and come smashing in over the side. The most disturbing phase of this increased effectiveness of attack became evident when it was launched directly over the stern. They put less water into the boat here than when they knocked off their hoary heads against the gunwales, but all that did come poured right across the motor. The outraged little kicker spat forth all the profanity of its vocabulary in the form of coughs, grunts, gurgles and sizzles, but the one fatal protest which I feared—that of stopping—never seemed to have entered its well-trained mechanical mind. Like the old-time mule-skinner, it appeared quite equal to doing its cussing and driving at the same time. That same string of explosive expletives followed every souse, but not for an instant was there a slacking of the steady tension of the tiller lines which told of a fully maintained steerage-way. And that was another of the cheering little beacons of reassurance to flash its

heartening message across my watery wilderness of worries.

A slight broadening of the seas, with a lengthening of the interval of trough, signalized the passing of the first patch of shoal, apparently a well submerged outpost of "The Thousand Rascals." Extracting what comfort I could from the fact that there were only nine hundred and ninety-nine of them left to run the gantlet of, I cast a hurried glance over my shoulder to see what next was to be reckoned with. High humping graybacks, foam-frosted beyond eyescope to left and right, filled the foreground and middle distance. A solider mass of wallowing whiteness almost dead ahead marked the ambush of the next "Coquin"—rather a toothier, testier varlet than the first one, if a frothing mouth went for anything. A dark slaty penciling on the far horizon revealed the thickening blur that would presently sharpen into the serrated line of forest wall behind a rocky shore. Nothing remotely suggesting steeple or factory stack pricked above the haze at any point; not even was there the up-ended cone of smoke pointing to an isolated sawmill. A wilderness of waters was rolling in against a wilderness of land—the twin wildernesses as they had unfolded to Nicolet, Joliet and Marquette three centuries before.

The stinging slap of a wind-flung wave-top nipped

incipient reverie in the bud and sent me aft to bring down the stern and submerge a racing propeller.

“Do you know the joy of threshing leagues to leeward of your port

On a coast you’ve lost the chart of overside?”

I mouthed the familiar lines through a frozen spray-spattered grin, and forthwith resolved to take the first opportunity to tell Mr. Kipling that I knew all—all but the joy.

As I closed in on the second reef it became evident that the seas were getting up much more rapidly than at the first, indicating, apparently, that the shoaling was less gradual. Too, there was a perceptibly increased tendency on the part of the waves to shoulder the boat along. This was especially noticeable when I knelt far back in the stern to keep the screw buried and threw the engine wide open. Speed would accelerate tremendously as the push of a wave was added to that of the motor, so that at times we would drive along for three or four seconds in the heart of the tossing crest, making from fifteen to eighteen miles an hour. Now and again the boat would even acquire enough momentum to shoot it into a nose-dive down the curling front of a wave—the thing which one always tries so hard to accomplish in running a South Sea reef in a surf-boat or outrigger canoe. The dizzy drop lets out the last link of speed, and, with a

double bank of skilled rowers or paddlers, it is possible to prevent broaching-to and upsetting about two times out of three. Here, with all the power under stern of the boat, there was not enough leverage to hold her straight for such a plunge, and I dared not risk what, with an empty boat and quiet water to carry into ahead, would have been no more than an exhilarating stunt. Throwing my weight forward and letting the propeller come up to churn nearer the surface effectually slackened headway and let the wave catch up and go rolling on ahead as we eased off down the back of it.

Shifting the weight forward or aft to raise or lower the screw gave a flexibility of control in rough water beyond anything I had ever dreamed possible, and I had gained a sort of rough working mastery of the useful little trick in nick of time. Two lively runs across patches of shoals no rougher than those already passed carried me on to the verge of another which, from the broad expanse of tumbling white it presented, was both shallower and more extensive than any yet encountered. A wink-of-the-eye-long survey ere I was toppled from a precarious crouch was encouraging to the extent of not revealing any actually breaking combers directly in my path. There were patches a few hundred yards on either side that looked rough enough for breakers, but even these I was not sure of. In any event, I was not heading

across the worst of the reef—certainly not where there was less than eight or ten feet of water at the shallowest. This meant that there would be no rocks to strike—that the half-breaking waves would be the only enemy to reckon with. The thought brought a renewed surge of confidence, my stock of which had been more on the ebb than the flow as various little odds and ends of straws pointing to the unenviable nature of my predicament continued to crop up. But since I was coming to master the finer technique of that wave-running trick, this next reef (I told myself), rough and broken though it was, would be really good fun. And so it was—for a little while.

There was something singularly reminiscent of the gathering swells beyond the outer reef at Waikiki in the way the waves were humping up ahead as I crouched in the stern to begin that memorable run. Block in a flashing crescent of coral strand, a fringe of tradewind-tousled coco palms and the fluted buttress of Diamond Head, and the picture would be almost complete, I reflected. My steadied nerves even permitted reminiscence to mount for a moment and ride on the crest of that new flood of confidence. I chuckled at a picture of my first surf-running upset and the ludicrous problem presented by the necessity of getting a three hundred-pound Kanaka back into the swamped outrigger. But no; it was not quite the place after all for flashing pictures of the past, no

matter how apposite, on the screen of memory. A very live and pulsing present had claims of its own. Driven by screw, the wind and a speeding wall of green water, the boat needed only the fillip of the Law of Gravity to send her toppling down the front of the wave that was trying to push beneath her keel. Sheering like a diving shark, she started swinging to port, burying her nose as she went. Bringing her back from under the engulfing broadside with a yank that scoured the skin from palm as the tiller line bit into it, I slid forward in an endeavor to let the stern lift and so reduce the impulse of the propeller. For the first time the pretty little trick failed to work, probably (as I have since reasoned it out) because of the surge of water against the stern. I dared not shut off the motor for fear of the consequences of losing steering-way. Throttling it to the last notch finally slowed the boat down enough to let the wave have the right-of-way, but not until she had ridden the crest for over a hundred yards with her half-buried nose throwing spray like a speeding destroyer.

Careful not to crowd the margin of safety so close on the succeeding waves, I still managed to steal enough of a ride on each to drive the boat along across the reef at a speed at least double of that she normally made under motor alone. It was a splendid run, quite comparable for zest and thrill to shooting a rough canyon rapid. Telling myself that the present

gait, if only it could be maintained, would take me to shore without another filling of gasoline, I cast a glance eagerly ahead to get a line on the chances of holding those fine, helpful, evenly-running shoal-made seas all the way in. With an approving grin, I noted that the tumbling water ran on as far as the eye could distinguish between white and green. Then the forward-cocked ear, relieved of the deafening side-swipe of the whistling wind, garnered a highly interesting fact which—due to the foreshortening of the broken wave ranks from my low observation point—had escaped ocular perception.

A heavy, sullen roar, raucously vibrant, thunderous, came drumming up the wind from the welter of foam ahead, sounding a familiar challenge. I had heard too often the crash of falling water shattering against solid rock to make any mistake about it here. With breakers ahead in more senses than one, I made a very earnest and laudable attempt to ship a pair of oars upon which I might fall back in case the engine struck and went to smash. Trying to steer with one hand and fumble the oars to place with the other, it is not surprising that I only made a partial success of either. Yet on other than an *ad valorem* basis, gain rather more than offset loss. That is to say, the weight of the water that broke inboard was about ten times the weight and volume of the oar that was lost over the side. That ended the brief but hectic pre-



A FISHERMAN'S HUT



ICING FISH

cautionary flurry. "Safety First" gave way to "*Sauve qui peut*," as the order of the hour.

Slithering down into the bottom of the boat so that I could just elevate an eye above the arch of the spray-hood, I took a double hitch around each hand with the slippery tiller lines and slowly humored the boat back upon the only course which it could follow without swamping—that dead before the wind and waves. The breakers were close at hand now—that was plain from the increasing roar, the higher hurled seas and the smother of fore-blown spray rising a hundred yards ahead. The vivid picture is still etched fairly clearly on the plates of memory; yet my outstanding recollection of the moment is of a whimsical attempt to put a brake on skidding nerves by humming, over and over again, a line of a popular song of my early boyhood. I never did know more than the single line, and I was not even sure of the air of that; but the sentiment, in its terse comprehensiveness, was sheer perfection. "He's up against the real thing now!" was the way it went. I was in the crescendo of about the tenth repetition of the prophetic words when my wail was washed down my throat and quenched for good by a wall of flying water. But how peculiarly appropriate to the occasion the sentiment proved!

CHAPTER VI

ON A LEE SHORE

I have never been able to identify beyond all doubt just which one of the "Thousand Rascals" it was that tried to block my way. My large scale chart of this section of the north coast of Lake Michigan, soaked to a pulp, had gone overboard in fragments via the bailing bucket. A smaller scale chart which survived showed, on subsequent inspection, that the two shallowest patches of the inner reef of the Mille Coquins had three and seven feet of water respectively. The actual depths in both cases would have been a foot or two less than those given due to the lowering of the general level of the lake by the Chicago Drainage Canal since the printing of the chart. Neither reef was shown in sufficient detail to give the variations of its soundings save in somewhat blurred contours, and these were not clear enough to indicate whether either one was threaded by a channel. That I was headed into what was at least the beginning of some sort of passage, however, presently became evident.

With the boat driving along fairly comfortably in comparatively evenly running seas while the breakers were combing over and cracking their heads against

solid rock less than a hundred yards off either beam, I began telling myself that my old friend, "The Sweet Little Cherub that Sits up Aloft," was climbing down from his perch and getting ready to intervene for me again. It was certainly by no navigational skill of my own that I had hit the hole in what had appeared to be an unbroken line of breakers. Where an attempt to steer more than a point or two off a course directly before the wind and waves would have meant speedy swamping, there was nothing to do but drive ahead. This I had done, and with no more sanguine hope than that the worst would be only an upset, leaving me something substantial to cling to, rather than complete disintegration against the rocks of the uncovered reef.

And yet here I was, while nothing but frothing combers thundered across black rocks to left and right, teetering along somewhat dizzily, it is true, but still under rather better control than among the waves of the more deeply submerged shoals outside. As line after line of breakers was passed without any perceptible contraction or shoaling of the channel through which I raced, the hope grew that I might still drive through unscathed what was probably the most formidable barrier I could expect to encounter. Hope strengthened to confidence as a decided weakening of the force of the waves became apparent, and confidence stiffened to conviction when, from the van-

tage of the foaming crest to which the boat was momentarily lifted, I caught transient glimpses of quiet water less than a hundred yards ahead.

Racking my brain to account for this unexpected lagoon of refuge, I all but overlooked the more imminent wall of tumbling white that held the solution of the mystery. The bow was shooting skyward up the back of a roller that was curling over onto bared reef beyond before I realized that the haven of my hopes was formed by an unbroken barrier of rock which effectually fended it from the attacks of the in-rushing seas. The passage through which I had been driven was a *cul de sac*, a blind alley completely closed by a barely submerged wall of reef that cut it off from the lagoon beyond.

A table of green-black rock, streaked with runlets of foam from the preceding wave, seemed rushing up to meet the bows as the boat toppled over the crest of the breaker and plunged downward. My mental reaction could not have been very different from that of a man diving from the top of a sky-scraper toward an asphalt pavement. I flattened down to avoid the solid impact of hard rock uncushioned by water. And so the crash, when it came, was an agreeable surprise. The blow was far lighter than I had braced myself, physically and mentally, to meet, while in place of the expected shivering of torn wood there was only the muffled rasp of metal. The breaker had put

down enough water to shoot the boat on across the barrier to the quiet lee of the reef without touching her keel.

The blow that the boat herself had missed by a hair had fallen with full weight upon the outboard motor. Saved from annihilation by its automatic tilting device, and from being knocked off into the water by the grip of clamps deeply countersunk into the oaken stern, the little kicker's crescendo shriek seemed to tell beyond doubt of a wound to the death. A buckled shaft and a lost screw were about the worst that could happen; a sheered propeller-pin the least. It might as well be one as the other, I reflected gloomily, for even the simplest repairs were out of the question with the boat wallowing gunwales-under in the least turbulent spot I had yet run into.

Administering the painless anesthetic of a disconnected battery to the screaming motor, I got out a spare oar to replace the one lost and worked the boat round to head into the wind, the force of which, now that I was no longer running before it, I became conscious of for the first time. Then, with an occasional steadying stroke, I bailed out the water and did what I could to retrim such of the load as I could reach without leaving the rowing thwart. Finally I rubbed the water out of my eyes and reared up on sprawling legs in an endeavor to get some sort of an idea of the lay of the lake and what it portended.

The greatly increased speed with which the boat had been driven over the several miles of shoals had furthered my landward flight beyond all expectations. The nearest segment of the forest-wall was not over five miles away; that to which I would be carried through the necessity of running dead before the waves perhaps a mile farther. The distinct line of gray-brown beach showing below the trees had more the look of rock than of sand. As the foreshortened wave crests made a mass of unbroken white beyond the narrow zone of comparative quiet in the lee of the reef, it was impossible to form any idea as to how far out from the shore the breaking surf was running.

The best—indeed the only—thing to do appeared to continue my shoreward run under oars. I decided to try it first bow-on, just as I had been doing with the engine. If unable to keep the following waves from breaking over the stern, I would still have the alternative of swinging the bow into the eye of the wind and backing to leeward before the storm. Finally, as a last resort, there would be my improvised sea-anchor, which, if it worked, would leave two hands free to devote to the several little duties that would doubtless be crying for attention. The plan seemed entirely feasible and—barring another uncovered reef and given a clear beach for the final run through the surf to a landing—I felt confident of carrying it through successfully. Renewed assurance came with the

heave of the oars. There is nothing like rowing to steady the fluttering ends of fraying nerves.

Scarcely had I settled back to a pull than I noticed that the motor, half tilted from its collision, was impeding progress by dragging in the water. Reaching over the stern to lift it higher, I discovered that the propeller was still in place and, apparently, uninjured. Turning the screw to look for scars, I was surprised to feel the handle of the fly-wheel nuzzling against my chest. For an instant the full significance of that innocent prod in the ribs eluded me. Then my jaw dropped with a gasp of astonishment as the wonder of the thing that had befallen struck home. That blessed little Elto had accomplished the miracle of sustaining the full impact of the blow from the ridge of reef without so much as sheering the propeller-pin. It was still ready to run, and, half a minute later, it was doing so—driving me shoreward again before wind and seas that continued to gain force with every passing minute.

While I may have been guilty of carelessness in not examining the engine at once, I might state in extenuation that the blow it had received was heavy enough to have disabled any kind of a propeller nine hundred and ninety-nine times out of a thousand. Why this did not happen here is only a matter of conjecture, but I am inclined to believe it was due to the fact that the collision was with a comparatively sharp

pinnacle of rock, which made it possible for the heel of the motor to strike and be tilted upward while the blades of the screw missed even the hundredth of a second contact that would have resulted in a sheered pin. I subsequently had several pins sliced off when propeller blades came in contact with nothing more stable than floating driftwood. The racing of the screw which made me assume that the pin had been sheered on this occasion was, of course, due to the fact that the tilting of the motor from the crash had brought the wheel almost to the surface.

The elation induced by the discovery that I still had an engine capable of hurrying me on to land was responsible for my worst slip of the day—an oversight that came near exacting a heavy price. All the way across the shoals my deepest current of apprehension had been due to a realization that the gasoline must be getting very near the bottom of the tank. The protected lee of the reef would have been the most favorable place I could expect to have for refilling. With the engine out of action, however, this had not occurred to me. Then, with the discovery that it was still in commission, my hands and mind were so occupied in hurrying on my way again before the storm developed overwhelming strength that I simply forgot all about gasoline until the last drop of it went up in an explosive gasp a half mile beyond the reef.

With the seas already rolling high again, putting

about and heading back against them to quieter water was out of the question. There was nothing to do but swing round into the wind and try the efficacy of my bailing-bucket sea-anchor, improvised against just such an emergency. It was fortunate that the oars were already in place in their ring row-locks; also that the seas were still somewhat broken in force by the broad expanse of reef astern. I am inclined to doubt, indeed, if the boat could have survived being brought broadside to the weightier, steeper waves that were running a mile nearer land. Even as it was, the sea that crashed against her port side tore off the fastenings of the spray-hood and deluged her from bow to stern. Wallowing drunkenly under the heaviest load of water yet carried, she still yielded obedience to the oars. Sidling up the next wave quarteringly she took a reduced dose of the rolling green, and its successor, met bow-on, she rode dry. Here I pitched the sea-anchor ahead and paid out its hundred feet of line slowly as the waves backed the boat away.

Despite a tendency to buck and tug like a roped broncho (due to the lack of a passage for a steady current), my makeshift sea-anchor performed quite effectually its function of holding the boat head-on the seas. Although pitching wildly, she rolled out about as much water as was taken in, and that gave me a chance to turn to with a coffee-pot and stew-pan and bail her dry. Filling the tank with the specially

devised can and hose was comparatively easy; without it I might well have spilled half a dozen gallons in getting one where it was needed, and that could hardly have failed to be mixed with water. The smashed spray-hood I made no attempt to restore. It was not of much use in running before the wind and waves, and I had to have it down to get out to take in the sea-anchor anyway.

The instant the sea-anchor was aboard I started the engine, throttled it down, and ran slowly against the seas watching for a favorable chance to turn. This I found in one of the occasional broadened intervals between crest and crest. As the boat descended to the trough I threw the timer all the way over and, as she jumped ahead at the kick of an accelerated screw, spun her around almost in her own length. The next wave did all it could to catch her broadside but the maneuver was the wink of an eyelash too quick for the marauder. Not only did it fail to put anything solidier than spray aboard us, but it also had to endure the ignominy of having us shoot along for twenty yards on its foam-bristly back. It was an encouraging start for the last leg of the race.

I passed over a number of shoals racing on shoreward but none shallow enough to create a risk of striking. The wind continued to rise but the danger from this was rather more than offset by improved steering technique. There appeared to be a lot to

learn about running an open boat before half-breaking seas, and the rudiments of the trick, at least, I was beginning to grasp. I was forced to do less bailing for the final five miles than at any other stage of the run before the storm.

I was hopeful right up to the last that a lumber or fishing camp would materialize at or near the point where I would have to attempt a landing so that a distress signal sounded on my fog-horn might bring willing hands to pick up the pieces after the final crash in the surf. In fact, I had the long tin funnel laid ready to hand to snatch up for the bray of S.O.S. Vain hope! Nothing even remotely suggesting a human habitation sharpened to focus on the questing lenses of my binoculars, either directly ahead or along the many miles of coast curving away to east and west. The one encouraging thing was the narrow ribbon of what appeared to be brown sandy beach beginning to show beyond the surf hardly more than a point and a half off the port bow.

I was just starting to edge over to maneuver for the cushioned landing promised by the bit of beach when a tiny island, reef-begirt and tree-covered, detached itself from the coastline to starboard, with a sharp point of rocks jutting out a mile beyond. With both island and point plainly offering sheltered lees where landings could be made with ease and safety, the realization that it would be suicidal to attempt the

four-point alteration of course necessary to reach either one of them gave me a feeling a bit akin to that with which a Lost Soul might look up from the Pit of the Damned to the shimmering portals of the Golden Gate. Of course I had to try the thing, but only to give it up by swinging back to present the stern to a curling wave whose predecessor had caught me quartering and left most of its broken crest in the bottom of the boat. Just how fortunate it was that my course had not been such as to leave me in a position to run for the lee of the island from the west I did not learn for a couple of days, when a walk along the shore revealed the intervening waters peppered so thickly with rocks that the boat could not have failed to be smashed before it had penetrated beyond even the outer fringe of them.

By the time I had bailed the boat free of water again I was running into the humping swells at the beginning of a three hundred-yard-wide line of surf. My first impression was that the bottom was a long gradually-shoaling stretch of sand, and so it was—basically. But when I glimpsed black rock-points thrust up through the cottony fluff of the foam to both left and right, I realized that the channel, if any, was very restricted.

As the surf salvos sounded off for the final showdown the situation was fairly clear. If I could avoid striking a rock or swamping in the surf, all that re-

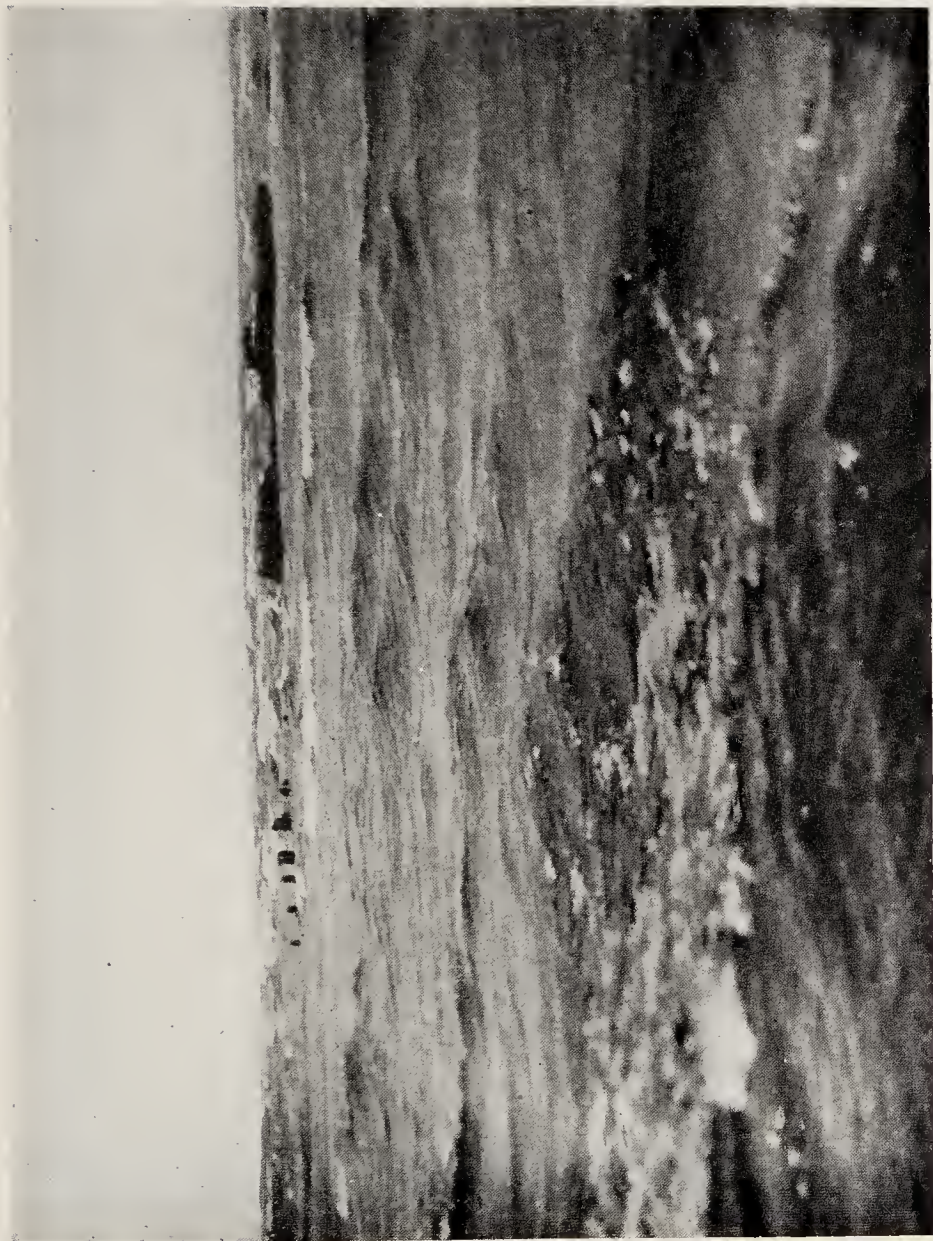
mained to be done to win the fight was to keep the boat from pounding to pieces when she hit the beach. For myself I no longer had any excuse to worry. A man who cannot take care of himself in a surf with a life-preserver on—barring a crack on the head from a rock, of course—ought not to play around big waters in small boats.

To postpone the moment of striking until I was as far in as possible, I shut off and tilted the motor as the boat began to ride the outermost breaking swell and headed for the beach under hard-plied oars. I gasped for breath as she made the first plunge, but rather at the giddiness of the descent than from the menace of it. Where I had rather expected to be engulfed, the breaking wave simply put its shoulder behind the stern and drove the boat ahead for forty yards or more before running on. Without the engine, however, I had not the momentum to get the jump on the succeeding waves in that way, and so each one of them in turn barged right on over the boat, leaving her wallowing deeper after every deluge.

More than half full of water while still less than half the way in, swamping before I reached the shallows seemed inevitable. Anxious to run into water at least shoal enough to give me a footing and a chance to keep the boat from swinging broadside and being rolled, I was pulling my hardest when the tail of my eye caught what I took to be the outlines of rocks

rearing high above the spray of the waves that shattered against them. It was necessary to swing the boat sharply to the right to miss the barrier, and as the next wave drove me by I had to bring my port oar smartly inboard to keep from cracking it against the blackened ribs of an ancient wreck. I had just managed to bring her bow-on to the beach again when she grounded, crunchingly, on hard sand. The next breaker swept over her from end to end.

Since I had been rehearsing mentally the next act for the last two or three hours, I was practically letter perfect in the theory of it. The idea was to tumble over as the boat grounded, leap to the bow and run the lightened craft right up on the beach out of harm's way. The theory was perfect. Practice, unfortunately, progressed only so far as the tumbling overboard. This I did so thoroughly that I was still clawing bottom when the boat—doing the identical thing I had been planning so desperately to prevent—swung sideways and, driven by the waves, came bumping along over my prostrate anatomy. Had I not been wearing a life-preserver my protesting hulk would have been a comparatively simple hurdle and the agony would have been quickly over. The buoyant kapok, however, kept me bobbing up just enough to turn the thing into a rough-and-tumble, with the boat on top and me—eating impartially water, sand and the paint off the keel—underneath.



THE OLD WRECK WHICH WE ALMOST HIT

After mopping up twenty feet of the bottom with my limp frame the boat finally ground it deeply enough into the sand to get over. Spitting water and profanity, I reared my abused head just in time to see my late command lodge solidly with her lakeward gunwales against the bottom and begin to fill with sand, the one thing I had feared above all others.

If there is anything that makes a rough, imperfect lump of human clay madder through and through than being mauled by a dumb animal it is being mis-handled by a dumb object that is not even imbued with the spark of lower life. When it is something that he has fancied his servant and which he has moved to his will, the irritation is all the worse. I have seen an Alaska "musher" beat with a club the runners of a sled which, after his controlling "gee-pole" had broken on a hill, had knocked him down and traversed the length of his spine.

I did not go quite the length of flying into a tantrum and beating up my perversely behaving boat, but in trying to tear her loose with one wild yank from the embraces of the encroaching sands into which she was settling so lovingly and contentedly I was doubtless guilty of seeking an equally childish and futile emotional outlet. My mighty "yo-heave-ho" moved the bow perhaps half an inch, and it settled back the instant the heave was over. One of the vertebræ near the base of my spinal column moved a slightly

less distance but remained where it stopped. That was because it must have run along the groove and slipped into the notch caused by the displacement of an ancient football injury. I had gone off the field on a stretcher the first time it happened, and at each subsequent recurrence, in various odd and impossible corners of the world, the medico inheriting the case—ranging from a *babu* interne at Mandalay to a Persian *mirza* with an American correspondence school degree at Bushire—had insisted on a considerable spell of inaction to restore the ruptured ligaments.

But the present was hardly a propitious moment for a rest-cure. With Science absent and Faith floored, there was nothing to do but let Nature take her course. All the rest-cure I had was in the form of the enforced hydropathic resulting from settling down into the water at the half-paralyzing pressure of the misplaced vertebræ—on the spinal-cord. The cold touch of the water numbed the pain, and I could have done nicely with several minutes more of it had not the boat, battered beachward before the wind-driven tide, begun to exhibit a desire to occupy my place. It took both hands dragging on one of the bow handles to pull me to my feet, but once up, it transpired that I was far less helpless than my imagination had led me to fancy. I could walk, stoop over to pick things up, and even—by setting myself carefully and distributing the strain—throw all of my

weight into a lift or a pull. Far from being crippled, I was in fairly good shape to begin salvage operations before drifting sand and rising water precluded all hopes of success.

With the boat in no danger save from that of slow burial, I was able, fortunately, to proceed with my work at a deliberate pace. After unclamping the engine and carrying it to the beach, the next thing to be done was to lighten the boat of its load. Although all of the canvas bags had been floating in water, none of them had taken much moisture inside. Neither did it appear that water had penetrated beneath the spring-caps of the gasoline cans. Such stuff as was in the forward compartment had to remain for a while, both because that space was half full of water and because my back was not equal to wriggling in through the small door in search of it.

It was against just such a storm and forced landing as this that I had planned the water-tight compartment forward, with a hatch on top to give easy access in emergency. The failure of the builders to follow my orders in this important respect left me with a boat that was not only easier to swamp, as well as less buoyant when swamped, but was also far more difficult to clear of load and of water when driven onto the beach. She was a wonderful little craft withal, and my confidence in and affection for her grew from day to day. Yet a compartment from which water

could be entirely excluded, and which could be reached without a wriggling belly-crawl, would have saved me many worries and much work.

With all movables high and dry on the beach, twenty feet back and two feet above the rising water line, the next thing to attack was the sand, several inches of which had washed over the starboard gunwale and now held the boat securely in its tightening grasp. Discovering that, as long as the boat was lying on her side, the waves would wash in the sand faster than I could scoop it out with a frying-pan, I concentrated on digging a hole under the submerged gunwale in which to insert the butt of an oar to use as a lever. Then, with my roller as a fulcrum, I gradually worked the gunwale free from the clutches of the sand and worried the boat up on an even keel. Water still splashed over faster than I could bail it out but, with the encroachment of sand from the outside checked, I soon got rid of the most of that which had accumulated inside. That lightened her enough to let me shove the roller under the bow and drag her a few feet toward the beach.

Skids improvised from driftwood slabs helped me work the boat along to a second roller chopped from a length of pine trunk. This elevated her enough to be above all but the splash of the far spent breakers and finally gave me a chance to bail her dry. After

that it was only a matter of time and hard patient work to bring her all the way out on the beach. Driftwood, fortunately, was plentiful, so that for the final fifty feet I was able to lay an almost solid skidway over which to run the rollers.

About two hours had elapsed from the time I first grounded until the unloaded boat was clear of the water. Considering that most of my effort was exerted in lifting and pulling at a weight of from four to six hundred pounds, not counting the suck of the wet sand on the bottom of the boat, it is a rather remarkable fact that a back injury which had previously put me on the shelf for days at a stretch did not seriously hamper me in the work. Indeed, although there have been a number of spells of lameness since, especially when sleeping in the snows of the Canadian Rockies a few months later, the effects of that extremely painful initial wrench did not really handicap me for active effort at any time during the remainder of the voyage.

With the boat out of danger for the moment at least, I overhauled my outfit and spread it out to dry. Bedding and clothing were damp but not soaked, and about the only damage was to some unprotected provisions in the open grub-box and the films in the two cameras. The rest of the films and food was either in cans or canvas sacks. A bath, a change to

dry togs, and a meal of fried sausages and potatoes baked by the embers of oaken driftwood made the world a cheerier place to live in.

The loss of my chart made location of the point at which I had hit the coast entirely a matter of guesswork. I knew that there were numerous jutting points and small islands along the north shore, so that the presence of those a couple of miles eastward of where I had landed were of little help in fixing my position. With the water still encroaching on the beach as the wind increased in force it did not seem advisable to explore far afield for the present. A half mile walk along the shore in both directions, however, convinced of one thing, and that was that I had been in no end of luck in the matter of a landing place. Where the forty-foot-wide mouth of a small river a quarter of a mile to the west offered the one point at which I could have done better, practically everywhere else the coast was armored with off-shore rocks among which I must certainly have fared worse. Regret at having missed the sheltered lagoon leading back from the river-mouth was but a drop in the bucket of my thankfulness over having stumbled on a way through the rocks to a comparatively easy landing on a beach of soft sand.

Still blowing from a sky unflecked of cloud, the wind continued to augment steadily in strength as the afternoon shadows lengthened, all the time driv-

ing the breakers farther and farther up the beach. At four o'clock high-water mark was twenty feet nearer the crest of the sand spit on which I had landed than when the boat had finally been dragged out. This rate of rise made it seem probable that the waves swept completely over the spit at the height of a southerly storm, which surmise was confirmed by the discovery of a line of driftwood on the farther side of a green-scummed sink immediately back of the beach. As the task of working the boat along through the inner breakers to the sheltered river mouth promised to be a good deal more than a one-man job, there was nothing to do but wait and see if the present blow was going to develop sufficient strength to put the water over the top of my precarious refuge. Even if such a rise did occur, it was hard to see how anything worse could result from it than the skidding of the boat down into the sink where, moored to the forest trees beyond, it ought to be as well protected as in the estuary of the little river.

Laying a skidway ahead, I dragged the boat up to the ridge of the spit, propped it on an even keel and dumped all my outfit back in the bottom to hold it down. After another piping hot meal, I laid a bed platform in the boat with the cut and fitted boards brought along for that purpose, blew up my inflatable sleeping-pocket, extended the canvas spray-hood all the way back to the stern and turned in.

The muddy sunset had a morbid, choleric, bilious sort of a cast, with not a ruddy suggestion of fair-weather promise showing up to its dying flicker. The gale let out another notch as the long twilight deepened to night, and a little after dark an aspiring breaker rolled in far enough to put a sizzling damper on the embers of my late camp-fire. About the same time the shrapnel-spatter of blown spray began its rat-a-tat on the taut canvas of my sheltering canopy, and an hour later solid water was swirling past my perch and tumbling over into the sink beyond.

Unable to move the well ballasted boat by direct methods, the treacherous flood fell back on the low, contemptible trick of undermining the props, thereby forcing me to tumble out into the spray-shot darkness on my feet before I was tumbled on my head. I had just pinched a bare toe under a roller in a clumsy attempt to start the boat tobogganing down to the sink, when a spatter of raindrops and a scurrying of blown leaves called my attention to the fact that the stars above the opaque wall of the forest were being blotted out by a turret of advancing cloud. Conflicting tongues of air met, grappled and struggled for mastery in the darkness. Then the wind from the lake fell lighter, faltered and died down, to be succeeded by a moist, gusty land breeze, dank with the smell of marshes and composed of about equal parts of flying leaves and fluttering mosquitoes.

There had been several trying intervals in the course of the day, but for sheer soul- and body-rending misery nothing to compare with the half hour of carnage that followed the advent of that thirsting horde of blood-suckers. It was probably an inflamed imagination which prompted the fancy that the fetid land-breeze was a funnel-shaped suck designed to draw down upon my tortured anatomy every mosquito south of Superior; but at any rate (with the trumpeting pests crowding so thick that they got in each other's way), things could not possibly have been worse even had such a concentrator been functioning. Being dressed to meet a shower of blown spray rather than a hurtled wall of bloodhounds, the abnormally extensive expanses of readily puncturable epidermis made me all the more vulnerable to the devastating attack. I did not need to be told of the futility of trying to employ my supposedly infallible "mosquitocide" dope against such odds. Acting from instinct rather than considered thought, I flailed myself through the ranks of the enemy to the boggy bank of the green-scummed sink and buried myself to the eyes under its evil-smelling waters. I have seen cattle on the Missouri and caribou on the Yukon, snorting with anger and agony, bury themselves from the swarming tormentor in exactly the same way. In his last-ditch straits man always inclines to follow the way of the dumb brute, and always to his advantage, provided he

does not allow the lump-iron of human intelligence to deflect the sure-pointing needle of instinct.

Man's spoken words in times of great trial, be they never so sincere, are seldom more than a superficial index to the working of his soul. To a listener on the bank the sounds that spattered from my scum-muffled lips might have had more the seeming of reflections on the ancestry of mosquitoes than of prayer. Yet from the depth of my innermost being there was winged an appeal to the God of the Lake Winds to send back the one Rescuer that could clear the field of the enemy. If that dear, beneficent, mosquito-paralyzing south-east gale would only return, I promised to welcome it with extended arms if it blew me and the boat into the tree-tops the next minute.

At the end of another hour of bull-frogging in the slimy depths of the noisome pool—an interval the sodden details of which are still too painful a memory to dwell upon—my prayer was answered. God's own good gale came back, first gustily, in scouting puffs of cool air, then in a clean, fresh stream that cleared alike the clouds from the sky, the mosquitoes from the air and the miasmatic vapors lapping the inflamed tip of stinger-drilled nose marking, buoy-like, my hiding-place in the scummy sink.

The landward squall—apparently no more than a local pocket of protest—was speedily obliterated by the major atmospheric movement once its first fine

careless rapture was spent. About the only traces of it remaining were my swollen arms and legs and several cubic feet of massed mosquitoes which had taken refuge from the lake-wind in my boat as their countless millions of brethren had been swept back to the forest. As they could not lift a leg above the gunwales without being swept out of the picture, however, all I had to do to escape them was to shake out my sleeping-bag and spread it on the wind-swept sand. The threat of the mounting tide had lost its terrors after that hour of misery and mosquitoes in the sink.

Washing off the stains of battle in a swift souse under the first line of breakers, I slipped into dry togs and turned in to drop off into the sweet, dreamless slumber of the tired ten-year-old. The day on which I had planned to put up a new record with a run from Manistique to Mackinac was at an end. For a day that had started with so bright and bland a fair-weather sunrise, I told myself drowsily, this one had contrived to crowd in a considerable variety of action. When my eyes opened again it was to blink into another golden sunrise.

CHAPTER VII

NAUBINWAY TO ST. IGNACE

Daybreak revealed the lake still rolling white to the ruffled line of a cold gray southern horizon. The outer cover of my water-proof bed was soaked but only from blown spray. Although the in-running waves had swirled up close to my feet in the night they had not been driven far enough to roll all the way over the sand spit again. Water level held all morning at a point about two feet higher than it had been at the time of my landing and it was not until a slight recession set in toward mid-afternoon that I felt it would be safe to leave the boat while I went in search of someone who could tell me where I was.

With neither house, clearing, nor even smoke showing along any of the many miles of coast-line visible through my glass, about the only thing left to do was to strike inland in a south-easterly direction on the chance that there was some kind of settlement on or near the bay that must lie beyond the jutting point to the south. The fore-shore became rougher and more broken as I worked along toward the base of the point, and from the way the surf was breaking over half a mile out into the lake it was evident that the waters were foul with barely submerged shoals. It

was into this treacherous reef-beset water that I was so nearly lured the previous day by the prospect of reaching the protected lee of the little island a mile off the point. There was no question of the shelter offered by the island against a southerly blow, but in all but quiet weather the only practicable approach to it would have to be from the east. The ruins of an ancient shack and some crazy net-drying wheels, visible from my present vantage through the glass, proved that the inviting loop of bay had once been the site of a fishing outfit.

The going proved good underfoot in the forest but the close-growing trees—birch, maple and scrubby oak—made it hard to push ahead in a straight line. Mosquitoes became increasingly attentive as the widening zone of buffering woods cut down the force of the wind that had driven them to cower in cover near the shore. Gloved, booted and netted to the nose in anticipation of having to wade through the ranks of the arch enemy, I suffered no great discomfort from the encounter, but a rabbit which I almost stepped upon was so busy pawing mosquitoes from his tortured ears and nose that he made several dabs even after I had scooped him up in my hands. Giving him a smear of mosquito dope on the forehead I left him wrinkling a querulous nose in the heart of a patch of buttercups. I have often wondered just what was that bunny's psychological reaction to the episode.

Certainly he never gave me sufficient credit for my charitable intentions. On the contrary, more likely, the smart of the pungent dope in his eyes probably convinced him that I was only a bigger mosquito with a new way of stinging.

At the end of an hour of zigzagging through the woods the roar of the surf on the rocky shore I had left still surged strongly down the wind. Not a little concerned for fear that the storm was rising again to endanger my boat, I was on the point of turning back when a new sound from somewhere beyond the masking frondage ahead began to make itself heard above the thunder of the distant surf. This was also a roar but more spasmodic than that from the steady grind of the mill of the breakers. When volleys of shrill higher-keyed notes began to slash through the salvos of deeper roars I was reminded of the shrieks of the whistling blow-holes of the Samoas, and this suggested that I was probably nearing a stretch of iron-bound coast honeycombed with great subterranean caves.

When these higher notes seemed to be resolving themselves into ululating cries like the keening of a banshee I was puzzled again. Half a century earlier an Indian massacre would have accounted for the racket, but hardly in 1924. Fisherman or lumberjack beating his wife? That would have accounted for the quality of the shrieks but the chastised wife

would have had to be a harem to furnish the volume. Sirens? Possibly; yet sirens sang to allure and these wails were more calculated to repel.

I was still pondering sirens when a break in the wall of the woods revealed an open stretch of greensward, the farther side of which was half encircled with dancing human figures. Just as I came out into the open there was a resounding and very familiar crack from the opposite side of the clearing, and as a very fat center-fielder chased an erratically bounding ball to my feet in a vain endeavor to keep a three-bagger from being stretched out into a home-run, the great swelling roar that had been puzzling me for so long broke forth again. When it died down the sirenic chorus had its turn, and this was the burden of its chant:

"When you're up, you're up;
 When you're down, you're down.
 But when you're up against Macmillan
 You are up-side-down!
 Whee-ee-ee!"

Macmillan, a town many miles away on the railroad, in coming to play a Sunday afternoon ball game with Naubinway, had brought its own girl rooting section, and it had been the vocal salvos of this highly trained squad that had bombarded me while I threaded the mazes of a mile of intervening woods. Bobbed

hair and near-silk stockings, with lip-sticks and powder-pad to resmear yell-spattered complexions! So sirens was the answer after all! But what a funny way and place to stumble onto them!

Melting inconspicuously into the mob along the side-lines, I discreetly waited until Naubinway had won the game by a spectacular ninth-inning rally before venturing a discreet inquiry as to just where the home town of the home team was. With neither house nor road breaking the solid wall of greenery on every side the question seemed to me an entirely pertinent one. The reaction of the dispersing knot of multi-uniformed ball players to whom it was addressed was rather that of men who suspected they were being kidded by the flippant stranger. So, quite naturally, they countered with as good as they thought they were getting. Admitting that Naubinway wasn't the burg it had been forty years since, they were still inclined to think that a guy who could drive his flivver down even what remained of Broadway without knowing he had been through a town ought to change his brand of bootleg.

My assertion that I had come through the woods on foot after landing with a boat on the beach at the base of the rocky point the previous afternoon was received with shouts of derision. My claim that it was an open boat apparently made the yarn all the more absurd. I couldn't peddle a fish story like that in

Naubinway even if they were fishermen. What was an open boat doing out yesterday when their big forty-foot launches had to run for the harbor and leave thousands of pounds of whitefish and lake trout and sturgeon to tear themselves to pieces in the nets? Why didn't I come right out and admit that I had a car-load of stuff hidden out in the woods and be done with it? Now *that* was an article I could peddle to them every day of the week and twice on Sunday, 'specially if it was some of the real thing from over the line.

My attempt to lend verisimilitude to my story by a carefully charted account of my run in past the old wreck gave them their chance to nail the yarn for good. Each of them hammered away at a spike of his own, but the one which stilled my final flutter was a flat-footed assertion that the wreck was high and dry in ordinary weather, while with a gale from the south blowing no boat ever built could be kept from smashing up on rocks that were planted so thick that they would reduce a sturgeon to fish-balls and caviar in the flip of an eel's tail. Dead fish were left stranded on the rocks after every storm but always too much hashed to do for market.

I threw up my hands at that and told the now considerable mob of skeptics that I was going back to look after my boat and that if they didn't believe I had a boat they could come along and see her with

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their own eyes. The movement to adjourn to the western shore was carried by acclamation but with many knowing grins and winks indicating that it was booze rather than boat which was expected to materialize at the end of the pilgrimage. They were ready enough to believe that I had run the reefs of the Eighteenth Amendment but not those of the Mille Coquins.

A grassy path to the mouth of the little river led back to the shore in half the distance I had traversed in working through the woods. The sight of my good little boat cocked up on the crest of the sand-spit changed a crowd of scoffers to a council of very practical and sympathetic friends. All of them fishermen, and therefore sapient of the ways of wind and water with small boats, they were not inclined to be censorious over my failure to locate and make the easier landing offered by the mouth of the little river. They knew perfectly well that nothing but luck had brought me in through the rocks, but they also appreciated what a toilsome grind it had been to keep the boat from burying in the sand and finally to work her out onto the beach. What they never did cease puzzling over, however, was the fact that so small an open boat had survived to run through and across the Mille Coquins in a blow that had been heavy enough to make them prefer to abandon many hundreds of dollars worth of fish rather than try to lift their nets while it lasted.

In the matter of getting my boat around to the shelter of Naubinway Bay it appeared that I had the choice of two alternatives. One was to hang on where I was until the weather became normal; the other involved launching the boat just as soon as the sea was down enough to make it practicable. As the former, though palpably the more conservative plan, meant a wait of three or four days and the dragging of the boat across the hundred yards or more of sand that would be uncovered as the wind-blown tide receded, I plumped for the course that promised less suspense and more action. The fishermen thought that conditions might be propitious for the attempt by the next morning. Two of them offered to come back to lend a hand with the launching, while another pair volunteered to run around with their launch to stand-by in case of trouble. I thanked them all and said I would let them know if I was going to need their help. The mess was of my own making and I was anxious to get out of it by my own effort if at all possible.

The wind fell off materially in force all through the night but there was still enough and to spare to keep the mosquitoes under cover. I slept like a log from an hour after sunset until daybreak, more than making up for my broken rest of the night before. The first light of another clear morning showed the water a foot or more below the level at the time of my landing, but with a dozen lines of breakers still running

and white-caps showing to the far horizons. Confident that the boat was equal to anything in the way of seas running in deep water once she was beyond the surf, I decided to try my luck at a launching without further delay.

With hard sand sloping all the way to the water's edge it was no great task to lay skids and rollers and run the boat to the spent line of broken froth that marked the beginning of the surf. Leaving her grounded just enough to keep from swinging, I brought down my outfit, an armful at a time, and loaded up. Dragging her out as the draught increased, she was afloat and ready to push off when the load was all stowed and the Elto reclamped to its place on the stern.

After the deluge of water and sand it had received I had little hope of getting the motor to start again without a general overhauling, and in any event not quickly enough to be of use in driving the boat out against the breakers. Even had I been sure of setting it spinning at a touch I would have been reluctant to risk smashing it by running before I was clear of the shallows and the rocks. I felt fairly confident of being able to clear the surf with the oars, and in this I was not disappointed. With the damaged sprayhood repaired and stretched again, the water thrown back as the bows were driven through the breakers was deflected so as to leave the boat comparatively

dry. Good sharp pulling to keep from being swept back and swung broadside to the rollers was about all that was necessary. Between waves I could take my time and maneuver to avoid the rocks.

Inside of ten minutes I was beyond the outermost of the lines of regularly breaking waves, but with solid white water showing in boiling patches at a number of points ahead it remained to be seen whether a channel could be found inside of them. Twice or thrice after turning south to double the point I was blocked by reef barriers and had to head back lake-ward in search of deeper water. Finally a lane of heaving green broken only by white-caps began to open up, offering a chance to try out the motor.

Sobs and snorts and strange gasoline-charged oaths of mechanical protest were all the responses the spun fly-wheel evoked until the last of the water was worked from the cylinders. With that off its chest, the old familiar pop resumed, sharp, staccato, pingingly purposeful, with never a pause or a skip. For a minute or two there was an obligato of grinding gravel running through the gasoline chorus; then the last of the swallowed sand was spat forth or pulverized to innocuousness. With all traces of indigestion over, my plucky little kicker was back on the job again with both cylinders.

It was lively going once I had turned far enough to bring the waves beam-on, yet dry almost to dusti-

ness compared with what had happened to me when I wallowed in the troughs two days previously. Small patches of shoals and isolated rocks were the worst trouble, and on the very openest course I could pick I had repeatedly to shut off and tilt the motor to save it from a collision. I could have avoided the worst of this danger by going a mile farther out but that would have taken me beyond the little island with its long tail of reef and into much rougher water. I had all of this that I wanted once I was off the point and from there on the bailing bucket was in steady use until I was inside of the crumbling breakwaters of old Naubinway Harbor. Running in past a row of fishing craft tied up along a rotting crib pier, I threw my mooring lines up into the welcoming delegation thronging the inner landing and came to rest with the bow burrowing deep into the ancient ooze of slabs and sawdust that formed the bottom of the bay.

A half land-locked bay looped in by a rocky tree-clad point, a row of weather-beaten shanties straggling along a grassy road, a gigantic sawmill in the last stages of dilapidation—that was all that was left of the glory that was Naubinway, once the banner town of the roaring lumbering days of the north coast. Nothing but blackened foundations remained of the First National Bank, the Thalia Opera House, the big department store and a score or so of saloons and dance-halls. The present inhabitants were all fisher-



A FRENCH CANADIAN FAMILY



THE OLD SAWMILL AT NAUBINWAY

men living in rough but picturesque little shanties that had sprung, phoenix-like, from the ashes of repeated conflagrations. With each rebuilding less pretentious and more make-shifty than its predecessor, most of the present structures nestled in the heart of diminishing squares and rectangles of former foundations.

The enormous tumble-down sawmill seemed to loom at the focus of every vista, both of reality and of fancy. It had been the Alpha and the Omega of Naubinway. Its building had marked the beginning as its ruin had marked the end. When King Lumber tottered from his throne on the Michigan peninsula his viceroy, the sawmill, died of starvation.

With the lake still too rough to make it practicable for the fishermen to go out to lift their nets, it appeared probable that two or three days would elapse before navigational conditions would be favorable for the resumption of my voyage. Art Turner, fisherman, farmer, store-keeper and boniface, came down to announce that a room had been prepared for me in his hotel, but a fish-house on the jetty offered a refuge more convenient to the boat in case the wind hauled far enough easterly to begin to blow into the bay. The French-Canadian owner of the shack very kindly ditched a case of under-iced fish that had missed the last shipment before turning the place over to me. I could hardly have expected him to do the same with

the keg of amber-colored fish-glue blubber and the two cans of sturgeon roe that would be worth five dollars a pound when it reached New York to be made into imported Russian caviar of the inimitable Aral Sea early spring vintage. With the fresh lake wind pouring through the cracks the little shack was comparatively fresh and fragrant—as fish-houses go, that is.

There was no barometer in Naubinway, the place of that instrument as a forecaster of weather appearing to be largely supplied by the “feel-in-the-bones,” especially those of the skeleton of a rheumatic French-Canadian half-breed woman named Gabrielle. In giving advance news of major meteorological disturbances the twinges of old Gaby’s rheumatiz had no near rival. For registering the intensity of a storm already raging, however, there was an alternative check. While the quiet waters of the sheltered inner harbor gave little idea of the force of the blow outside, it was claimed this was accurately indicated by the roar of the surf breaking on the rocky shore between the beach at which I had landed and the end of the point. So long as this was louder than a distant mutter it was deemed too rough to lift nets except to save them from destruction. This sound-of-the-surf test, my fishermen friends agreed, would be a safe touchstone by which to decide on a favorable time for my departure. While the two-mile-distant roar came

throbbing through the woods, they said, I would be better off in port. When it died down completely I would be quite safe in pushing on to Mackinac.

Most of the fishing boats remained at their moorings the day of my arrival at Naubinway. The two or three which ventured out returned to report badly damaged nets, with most of the fish that had not escaped either dead or too badly bruised to be marketable. Among the catch brought in was a young sturgeon, which Mrs. Art Turner promptly pounced upon to cook for my supper. It had a rich if somewhat strong flavor, though my unpiscatorially sapient palate failed to discover anything in the oily cutlets which would justify the high premium sturgeon brings in the New York and Chicago markets over whitefish and lake trout.

The counter of Art Turner's store had once been the bar of the saloon and dance-hall called "The Lumber Jack's Luck." Not all lumber-jacks were lucky there, however, as I learned in listening to the chatter of a garrulous old Frenchman called Bateese who had accepted my invitation to wolf a dish of Mrs. Turner's homemade strawberry ice cream across the scarred black walnut slab of hallowed memory. Bateese himself had had an ear chewed off while rolling in a rough-and-tumble in the sawdust of that very floor, but this was nothing—"pouf! a leetle bite of flea"—to what happened to "Big Mouth" Flannigan

the time he gave the great push-slide to Mimi, the dance-girl.

Mimi was the most loved siren of her day in the lumber camps of the north coast, partly because of her personal pulchritude but principally on account of a number of ingratiating little ways and tricks she had which especially endeared her to the heart of the timber-jack. The most famous of these was a literal form of "timber-cruising," in which Mimi allowed the patrons of the house to slide her plump and pleasing anatomy on the polished bar. Distance was the essence of the competition, with the high men receiving a graduated number of kisses from Mimi's pink lips, while the low men paid for the drinks at a rate which allowed the girl a fat rake-off.

It appears that the chivalrous French-Canadians, for whom the engaging little game had been originally invented, had always taken the greatest care to play in a way calculated to bruise to a minimum both the maidenly feelings and the maidenly form of the gentle Mimi. Others were inclined to be less considerate and the most un-Bayard-like of the lot was the wild Irishman, "Big Mouth" Flannigan, the fighting bully of a near-by logging camp. Flannigan had gained his nickname from the fact that he had a spread of jaw wide enough to allow him to pick his teeth with a cant-hook. Where an ordinary man in a rough-and-tumble had to content himself with nipping

off no more than a nose or an ear, "Big Mouth" had simply to open up his cavernous jaws to be in a position to masticate the whole side of an antagonist's face.

Now that was all right in itself, according to the Frenchmen. Since all was fair in a lumber-jack's fight, if *le bon Dieu* had seen fit to provide one man with better weapons than those of his fellows, it was that man's fortune not his fault. But where "Big Mouth" transgressed was in extending his cave-man methods to the flower-like Mimi. They had no legitimate objections, they admitted, when the big Irishman shuffle-boarded Mimi the whole length of the bar and off onto the ice-box at the other end. That was all in the game. Moreover, seeing that this particular push had broken all existing broad-slide records, they could not conscientiously hold that "Big Mouth" was guilty of serious dereliction in lingering overlong in the collection of his legitimate reward. Even Mimi herself was quite willing to pay double for so important a feat.

It was in forgetting that he was dealing with a lady rather than a log of spruce that "Big Mouth" stepped over the line of propriety with both feet and so laid himself liable to being set right on the finer points of etiquette. Not satisfied with having mopped the whole length of the bar with Mimi's abbreviated pink skirt, the elated log-roller needs must seek a broader

field of activities on the bar-room floor. Mimi, unfortunately, was not dressed to slide on the slivery surface of new-sawed pine. Her own fair form hurtled the whole length of the room under the impulse of "Big Mouth's" titanic heave, but her costume of pink silk and chiffon, not overly voluminous in the first place, mostly was impaled on slivers and left in her wake; also not a little torn hair and shredded cuticle. Much of this loss was replaced by small sharp particles of pine; in fact, Bateese assured me that Mimi was studded so thick with slivers that she looked like a cross between a wooden porcupine and the slab pile of the shingle mill the day after a cyclone. Indeed, the unlucky girl lost so much hide, according to Bateese, that she "nevaire again can wear the gown cut décolleté to the knees!"

In view of the fact that the north coast of Lake Michigan has numerous spells of winter temperature in which the thermometer goes down to fifty and more below zero, perhaps it was just as well for Mimi that something happened to force her to cut her gowns a bit higher than that in the neck.

Bateese told with much gusto how "Big Mouth's" lesson in the way to treat a lady was taught by the gentle medium of the blades of a brace of double-bitted axes. Every few moments he would punctuate his descriptions with the exclamation, "An' the wondaire ware zat diable was not kilt!" But although it

was claimed that the smallest hole in Flannigan's head when that schooling session concluded was "hees beeg mouf," that there was still life and spirit left in the wild Irishman is attested by the sequel, in which he led Mimi to the altar and married her by bell, book and candle before his cloven lips could more than lisp "I will." He was crushed to death trying to break a log-jam a few years later, but Mimi lived to develop rheumatism and twinges in her bones that could foretell the coming of a storm a week ahead.

I made a brave endeavor to revive the spirit of *les vieux temps* by offering a gallon of ice cream to any one who could slide anyone else half the length of the historic bar. Several buxom fisher maidens came gigglingly forward to volunteer as slidees but the well meant plan went awry for want of sliders with sufficient energy. A half dozen gangling youths only grinned sheepishly and reckoned it would be too much work to hoist so much weight up to the bar without a derrick. Naubinway's physical decline has evidently been accompanied by a corresponding ebb of spirit.

There was no moaning of the bar when I awoke in the morning, the reason for which became plain when I found a thick fog blanketing the waters of the bay. A fresh south-west wind which cleared the air along toward nine o'clock brought with it a resumption of the ominous mutter from beyond the point.

All of the fishermen put off to lift their long neglected nets as the visibility improved but cautioned me to await their return with a report of the conditions outside. The first boat came back about noon. Her skipper said that while the weather was still unsettled and somewhat threatening he could see no reason why I should not make a cautious run along the coast at least as far as Epoufette. After noting directions for reaching the lee of a couple of small islands in the event of another blow I cast off and got under way at one o'clock.

The seas were south-westerly with a long roll just breaking into white-caps with the freshening breeze. As there was a suspicious similarity in these conditions to those preceding the big wind that had caught me so far off shore the day I left Manistique I kept an eye lifting warily for possible shelter from the moment I had rounded Point Biddle. Although rocks showed near the surface every now and then, the coast proved by no means so badly beset with reefs as that to the west.

I had run to within three miles of the tip of the long finger of Point Epoufette when the wind hauled to the south-east and began blowing with a force that soon sent the spray flying back over the engine. The surf was breaking noisily on Pelkie Reef as I came abreast of its shallowly submerged table, and for a half mile I found some protection from the mounting seas by



BOAT ON THE BEACH AT EPOUFETTE



LOG HOUSE AND FLOWERING ORCHARD AT EPOUFETTE,
NORTH COAST OF LAKE MICHIGAN

running in its lee. A tongue of rocks, many of them barely awash, extended far into the lake from the end of the point. Rather than risk a swamping by heading out around them I shut off the motor and worked my way through with the oars. Then I turned north and ran for the shelter of the most easterly of the several indentations forming the deep Epoufette Bay.

A fishing launch occupied the only berth at the pier but its owner came out to point me a way to a landing on the rocky beach. A dozen or more boys and girls, rushing down from a large house set back among the trees, lent practiced hands in dragging my boat up beyond the wash of a surf that was pushing landward before the rising wind. The youngsters said they were a portion of the Bellant family which farmed and fished and lumbered around Epoufette Bay. Bellant *père* I found in the fish-house at the end of the pier; also a black-robed figure whose bloody hands and arms suggested the priest officiating at some ancient sacrificial rite. He turned out to be only the district curé paying his weekly visit to the Bellants to celebrate family mass. Being inordinately fond of fish livers he was allowed to take his tithes by extracting his favorite tidbits as the morning's lift was cleaned for icing and shipment. With a gallon can almost full of livers and cracked ice the good father was fairly licking his fat jowls in

anticipation of the feast that would follow his return home. He was a genial chap but rather inclined to the flesh-fleshy; also—judging by a refulgent maroon beak—to spirituousness rather than spirituality.

After I had made the boat snug for the night Bellant asked me over to take a photograph of his wife and the latest of her four or five pairs of twins. When I suggested we include the whole family in the picture the *habitant* grinned and opined that my camera was hardly large enough, even with the group unswelled by the three or four elder children who were working elsewhere. When I replied that my camera had already taken a picture of a whole regiment of infantry he grinned again and said he would do what he could to chivvy the most available of his *enfants* together and see what could be done. The group had to be expanded several times to make way for late comers straggling in just as I was ready to shoot. The bunch of something less than twenty was far from complete when I finally snapped my shutter to beat the fading light.

Monsieur and Madame Bellant told me more about their large but still rapidly growing family when I came over for a visit after supper. They were forty and thirty-eight years of age respectively, and their even two dozen of living children had come into the world in twenty-two years of married life. This splendid record had been put up in spite of the fact

that their first child had died, while another season the baby crop, like that of apples, had been a complete failure. Both were a bit apologetic over these stumbles in the race but still pointed with pride to the fact that the annual average had more than been maintained by the quartette of twins.

The children, young and old, were a robust, energetic brood, well-fed, well-washed and neatly dressed. They were respectful to their elders and appeared thoroughly disciplined. Better still, they were good sports, as was conclusively demonstrated when I took advantage of the hard maple floor of the kitchen to revive the classic sliding game of "Beeg Mouf" and Mimi. The smooth planks were so thoroughly polished by grease and shuffling bare feet that Bellant and I repeatedly got too much distance with the older children, while the latter in turn had the same difficulty with the youngsters. Yet the only howls produced by a dozen or more bumped heads were purely those of ecstasy.

Julie, the sixteen-year-old daughter, was the gamest one of all. It was Bellant's turn to slide, but, surveying an amplitude of latitudinal and longitudinal dimensions already beginning to vie with those of Madame, he shook his head and begged me to lend a hand. Between the two of us we mustered power for a mighty shove, but the dual control gave faulty direction. Julie shot off on an angling course

that carried her to a stretch of floor temporarily patched with pine, and, like Mimi forty years before, she was not dressed to slide on slivers. Notwithstanding which the pretty minx displayed, among other things, both *sang froid* and *savoir faire*. Backing out of the room with a graceful curtsy, she said it was bedtime anyhow and thanked her father and myself for what we had done in getting her so nearly ready for turning in. I have seen ladies of greater sophistication carry off a similar situation with less aplomb at the Bal Quatre Arts.

With perfect local weather conditions the next morning, I started early and ran hard and continuously to reach St. Ignace before the breaking of a storm which appeared to be working up from the south behind a rolling bank of thunder clouds. With but a light sea and few shoals to avoid I made fast time to Point aux Chenes, beyond which the island of St. Helena and the converging Straits of Mackinac offered ample shelter from any wind that might blow. Passing Point la Barbe, I left the buoyed channel and cut in across the shallows to double Point St. Ignace and open up the well protected bay beyond. With Mackinac Island abeam to starboard, distant four miles, I headed in toward the crescent of piers and docks built on or near the historic landing of Father Marquette.

Thor of the Thunders was still muttering in his



"MARQUETTE'S LOOKOUT"—ST. IGNACE



FRENCH CANADIAN FAMILY HELPING TO RE-LAUNCH THE
BOAT

beard off Lake Huron way but did not appear to be meditating any northward movement for the moment. Seeing the field clear of the lion for the nonce, a sneaking jackal of a "white squall" took the occasion to slink from its lair in the hills back of St. Ignace and start on a scavenging raid on the bay. Its coming was unheralded save by a sudden creaming of the surface of the water as it was kicked up into short almost perpendicular waves. I just had time to see a train-ferry, its aim for a narrow slip spoiled by the sudden side wind, go crashing into the end of a pier, and a sloop, caught aback, blown flat, when a half-solid wall of air and flying spray turned my attention to things nearer home.

That would have been a nasty bit of a blow to meet and fight it out with in the open lake; with a sheltered lee but a few hundred yards ahead it was only a matter of weathering the first onslaught and then plugging along into the teeth of the squall under a slowed engine. A big fishing launch standing-by to pick up the crew of the capsized sloop saved me the unpleasant task of trying to work over to her with my vulnerable beam presented to the slapping waves. Five minutes of pounding through torn wave-tops that exploded and flew yards astern as the bow crashed over them took me in to the quiet slip of an ancient boat-house, where a genial old Scot made fast my painter and bade me make the place my headquarters

as long as I cared to "bide in auld Saint Ignus." He paid me the wholly undeserved compliment of saying that I appeared to be a glutton for dirty weather, and then went on to tell about a lad for whom he had built a sloop many years ago who liked nothing better than to crowd on all sail and go out and play tag with the squalls in the Straits of Mackinac. The boy's name was Edward White, he said, and he had later moved off somewhere California-way. He wondered if I had ever heard of such a lad out in that section. It was a pleasure to assure the keen old sailor that Stewart Edward White had survived the squalls of Mackinac to win an enviable reputation as a writer and hunter, and that his name was the synonym of keen, clean sportsmanship over a very considerable part of the English-speaking world.

CHAPTER VIII

INTO CANADIAN WATERS

Marquette had characterized the Straits of Mackinac as "the home of the fish." They abounded in other places, but here was where they swarmed. Judging by the number of fishermen basing at St. Ignace, the same holds true to-day. It was from these fishermen, some of whom were related to my friends at Naubinway, I had been assured I would be able to gain information as to the most favorable course to follow around the north end of Lake Huron to the protection of the islands of Georgian Bay. The charts bristled with soundings, which were all right in their way, but really needed to be supplemented by the intimate little personal tips as to local weather idiosyncrasies, refuges, habitations and the like, such as none could give so well as the man to whom the navigation of the shallows was the daily grind.

I found the denizens of the St. Ignace waterfront as friendly as their brothers who had mothered and sheltered me all along the stormy north shore, but, unfortunately, quite unsapient of the waters I was about to enter. Their fishing was all to the south and the west, they said, and never in the Canadian waters which I would navigate as soon as I passed Drum-

mond Island and headed into the North Channel. The best advice they could give was to work across to the Canadian islands by the shortest open traverses possible, and then to gather local information from the fishermen and lighthouse people, as I had done along the Michigan coast.

Captain Green, of the U. S. Survey steamer *Search*, lying for a few days at the St. Ignace dock, could tell little more of Canadian waters than had the fishermen. He gave me a better chart than any I had of the north end of Huron, however, and also the very wise advice to get on to Mackinac Island at once rather than to hang on for the night at St. Ignace as I had planned. The barometer was falling, he said, with warning of cyclonic conditions of great intensity developing to the south. I might as well reconcile myself to spending much time in port for the next few days, but there was no reason why, watching my chances between blows, I should not run considerable mileage when weather conditions were favorable locally. Hence his recommendation that I make at once the run to Mackinac Island that would probably not be possible on the morrow.

It was disappointing to forego the opportunity to tread in fact and fancy the pathways of the gentle Marquette, and disappointing likewise to miss the yarn I had been promised that evening with the good old Scotch boat-builder and some of his bosom cronies.

But Captain Green's advice was too sound to be rejected. If, as appeared very likely, I was going to have to continue to keep port for spells of three or four days at a time, the only possible way in which I could hope to finish through to New York inside of the time-limit imposed by my later trip to the Canadian Rockies was to take advantage of every hour of weather sufficiently fair to permit of reasonably safe navigation. This was going to mean playing hide-and-seek with many a gathering storm, but as long as I could maneuver to keep from being caught far off-shore again I was not especially apprehensive of anything much worse than occasional buffetings and wettings. The reliability of my engine and the fact that I could count with reasonable certainty upon saving most of the outfit in an emergency landing were both highly reassuring. Chastened by my experience in the North Shore storm, I was still far from disheartened. The voyage was proving even more of a fight than I had anticipated, but a fine, keen, zestful sort of a fight, now that I had learned the folly of attempting deep-water traverses.

The strait was a lane of hard polished indigo when I pushed off at six in the afternoon, with the waves running fitfully from the south, where a sinister bank of clouds told of windiness on lower Huron. There was a flood of dusky purple streaming through the nimbus which masked the low-hanging sun—palpable,

almost liquid light that settled down upon and seemed to cling to the surface of the water like a flat stratum of fog. Mackinac Island, bathed in the magical glow, loomed monstrously against the south-eastern skyline, blurred and blank, with the mystical silhouette of a castle of trolls.

Just which lurking center of potential trouble was going to hit the strait first one could not be quite sure. All that was really clear was the sky overhead and the fact that in not very much over half an hour the middle of historic Mackinac Strait was not going to be a comfortable place to be caught in an open boat. And so, like a rabbit diving for its hole between converging hounds, I scurried for shelter—scurried with all the kick my powerful little Elto could muster.

Maverick wind-gusts, teetering trippingly by like toe-dancers, caught me now on one side, now on the other, but never with sufficient singleness of purpose to wreak harm. Once two of them tussled a hundred feet beyond my speeding bow, but lightsomely and playfully and with little malice aforethought behind the hard-flung spray which the victor kicked up as it spun on its heel and prepared to chivy the vanquished back into Lake Michigan.

The real squabble for the possession of the strait took place a half mile ahead and, very fortunately, was all over before I came chugging along onto the battlefield. As I had surmised, the real power was



NO TAXI COMPETITION ON MACKINAC



SAILING OFF MACKINAC

all with the cohorts closing in from Huron-way. Fur flew fast for a minute or two while the main disturbance established its supremacy; then the minor squalls from the west and north turned tail and ran for cover. One of them trampled me underfoot in passing but was too frightened to stop and hold me down.

The forefront of the advancing storm was as clean-cut as a tide-rip or the screw-churned wake of a steamer. On one side was the unrhythmically wallowing blue-black water in which I had run all the way from St. Ignace, on the other the almost unbroken foam-blanket formed where the wind was ripping the tops off the swiftly mounting white-caps. This would have been hopeless to have considered breasting for any length of time in the open lake; with Mackinac Island less than a mile away, and to leeward, nothing worse than a lively scrimmage was promised.

My problem was a comparatively simple one. To make the entrance of the completely sheltered Mackinac Bay I would have to run a quarter of a mile with the wind and rising seas abeam, about half a mile with them on my starboard quarter, and the final quarter-mile to the harbor with the storm dead astern. The crucial test would be the attempt to navigate athwart the waves. If this proved too much for the boat to stand, there was still the perfectly feasible alternative

of turning and running dead before the storm to a landing on the steep but fairly clear strip of beach clearly discernible below the lofty bluffs of the southwestern end of the island.

That first quarter-mile with the ambitious young combers trying to climb the starboard gunwale was a merry dance. The wind threw a vicious cut into its lashings, and streamed from its fount in a bituminous smear of tattered cloud with a purposefulness that was just a bit appalling at the first onslaught. Quite unable to hold the boat to her course while handling the bailing bucket, I simply barged ahead, determined to let the water take care of itself until there was enough of it to interfere with navigation before turning and running for the beach.

This point was never reached. Drenched myself, both from flying spray and solid green surges, there was still not enough water in the bottom of the boat to cover my shoe-tops when the buoy was reached where I could alter course the four or five points to port which brought the wind and waves that much farther astern. I was still too busy to waste good time on bailing, but very little more water had come aboard when another alteration of course was possible, this time making it practicable to run directly before storm. Two minutes later I had rounded the end of the breakwater into a pocket of land-locked

bay the surface of which was barely ruffled with the tails of the gusts scurrrying along overhead.

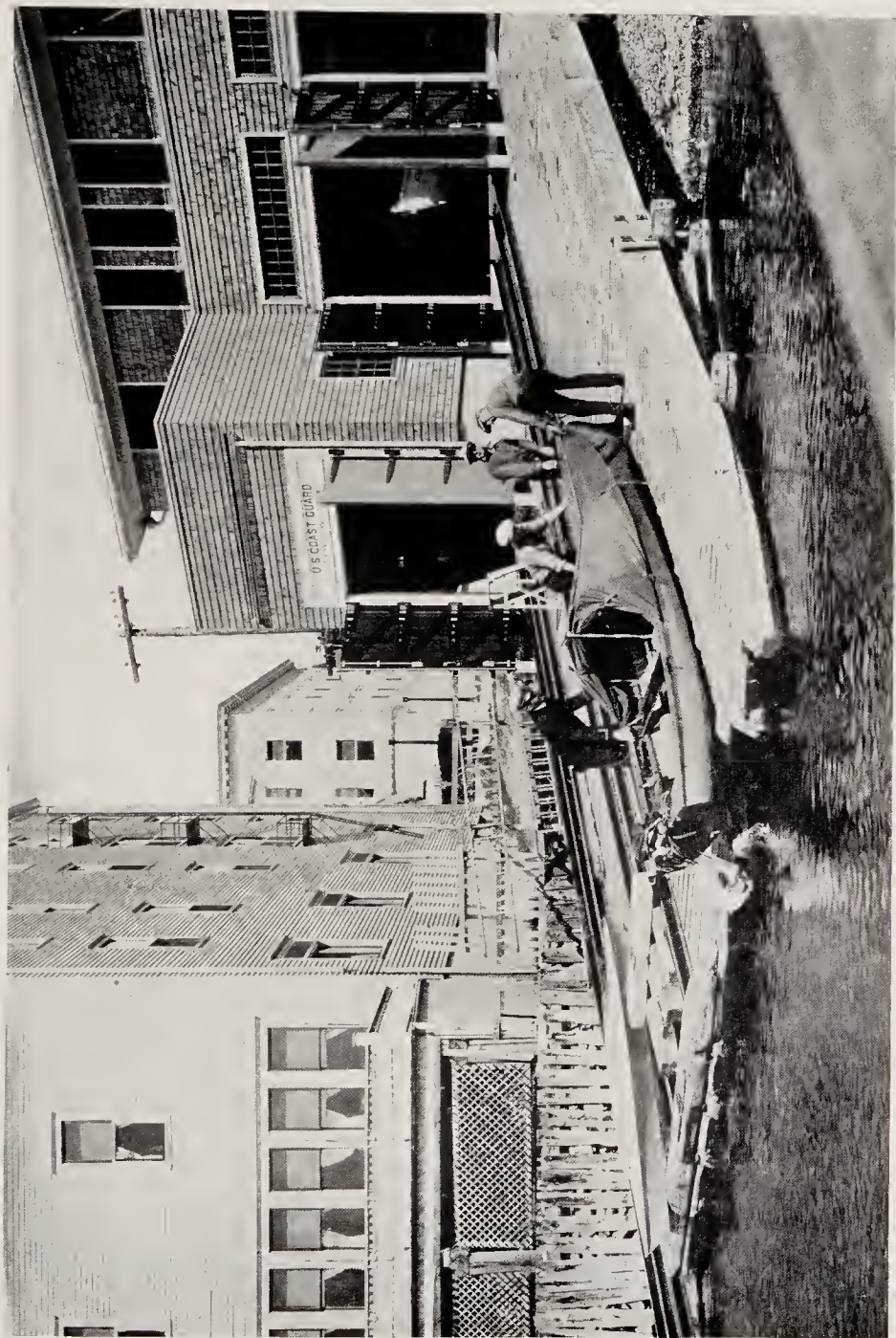
The transition from the savage bluster of the storm to the idyllic peacefulness of the bay was as sudden and surprising as a feat of legerdemain. One moment the boat was in the heart of a vortex of warring waves which shouldered and scuffled for a passage through the narrow channel; the next it was running in a surface that was almost glassy in its smoothness. The breakwater had killed the waves, while the imminently looming bluff stopped all but the few breaths of air, soft as a caress, which came purring down from the inner slopes drenched with the perfume of blooming lilacs.

Historic old Fort Mackinac dominated the picture, its whitewashed walls and bastions standing out sharply against the somber green of the forest-clad slopes. Villas and hotel straggled along the amphitheater of hills, with a crescent of shops and docks ringing the harbor front. Through breaks in the buildings a lazy line of traffic could be glimpsed straggling along the single street. In blended lakescape and landscape there was a haunting air of peace and quiet that suggested at once the Isle of the Blest which Mackinac really is.

The Captain of the Coast Guard station came down to meet me at his landing. Ordering his men to drag

the boat out on the launching stage, he told me to make myself at home until the weather was favorable for continuing my voyage. The boat would be safe where it was unless the storm shifted to the north-east, in which event he would have it brought inside. A tremendous disturbance was brewing to the south according to all signs and reports, he added, and it would be best not to try to run across into the North Channel until I was sure of at least two or three hours of fair weather. This might not be for the next three or four days from present indications.

Stepping out onto the street of Mackinac Island was like turning the clock back twenty-five years. This illusion was principally due to the traffic. Shops and costumes were modern, but all movement was either on foot or in the ancient horse-drawn vehicles beloved of our grandfathers. Even the jaunty dog-cart was exceptional. The predominating type of carriage was that quaint two-seater with a fringed canopy called, I believe, a "surrey." Long lines of these queer survivals of a bygone age met the steamers and drove tourists up to the fort and around the island. Even the drivers carried the suggestions of having been rolled up in lavender for three or four decades in a box in the attic and then unpacked for the occasion. There was a familiar touch in two of them at verbal fisticuffs over the matter of precedence in approaching a prospective fare.



WE LAND AT THE COASTGUARD STATION

Mackinac has wrought better than it knows in banning the automobile. What world-weary soul but will hearten at the word of streets and roads where lake ozone vies with the fragrance of lilac bloom and the defilement of gasoline is unknown. All that is needed to complete the picture are hotel orchestras playing old time melodies instead of jazz, and a discontinuance of tourist steamers. But perhaps this sort of an Elysian Fields annex would be asking a bit too much.

In order to give a hand with my boat in case of trouble, I spread my bed on the floor of the Coast Guard station, sleeping with an inch of clearance between my unpillowed ear and the propeller of a lifeboat. The bay was quiet as a millpond all night, but the crash of breaking seas from the south-east told that the blow continued furiously from the same direction it had swooped to chase me into the harbor. The first mile or two of my run on to the northerly mainland appeared quite smooth from the level of the landing, but beyond this lee the waters were an unbroken expanse of wind-whipped white.

Yarning with storm-bound fishermen along the waterfront, I gathered that the safest course to pursue from Mackinac would be the somewhat indirect one to the thick-set group of islands called Les Cheneaux, fringing the upper peninsula of Michigan. This offered the minimum open-water traverse, with

many miles of winding but fully protected passages in which to make my easting in working along to the strait leading to Detour and on into the North Channel, which forms the southern drainage of Lake Superior. The advantages of this route over the more direct but also more open one to the east was evident as soon as the Captain of the Coast Guard station traced it for me on the large-scale chart he kindly put at my disposal for the run. This decided upon, it only remained to find a sufficiently quiet interval for the twelve-mile traverse to the nearest opening in "The Snows," as Les Cheneaux are popularly called. This might not come for several days, the Captain cautioned, adding that the present disturbance was only the forerunner of a terrific general storm almost due to sweep the lakes to the south.

With at least a day on my hands, I spent the latter part of the next forenoon in a ten-mile walk around the island and the afternoon clambering about the ancient but still remarkably well-preserved fort. Learning that the old John Jacob Astor trading-post had been converted to a hotel, I sought out the historic place for supper, thereby missing two hours of lighter breezes in which I could have made the run to "The Snows" with little risk.

I found ample compensation at the old post, however. Most of the ancient buildings had been altered beyond recognition, notably the former trade-room,

which had just received the hardwood floor that converted it into a modern ballroom. The warehouse, with a crude hoist which worked by running thongs of hide over a large wheel, was perhaps the place least scarred by time and change. The doors, studded with great hand-wrought nails, still swung on the mighty hinges that extended all the way across their ax-hewn slabs. In a corner was the remains of a press that had been used to bale the salted hides for shipment.

The real treasure chamber was a small neglected room at the head of a rickety stairway, long disused. It contained a half dozen iron-bound chests, broken of lock and hinge, bulging full of the old records of the historic frontier post. There had been no effort to preserve, no endeavor to segregate the priceless documents. They had simply been dumped into the old boxes and left. How much had been destroyed or carried away there will never be any way of telling.

With the call for supper sounding, there was time for just one dip into the treasure chests before me. Thrusting wrist-deep, as into a grab-bag, I retrieved what proved to be a sheaf of ancient letters. Taking one at random I ran hastily through it. The well-formed characters in faded yellow ink were evidently the chirographic efforts of a man of some education writing at the behest of an outpost trader who thought he had a grievance.

The man was objecting in no uncertain terms to

the outrageous action of the parent post in charging him all of a dollar and a half for a case of whisky! So altitudinous a figure would have been bad enough under any conditions, he complained, but when all the world knew that his squaw was a missionary-educated girl and even more avid than the average Indian maid in her thirst for fire-water, it was downright robbery. Furthermore, if the wrong was not rectified, it was the intention of the aggrieved party to leave the service of the company without further notice and turn free-trapper. And if his ungrateful employers did not believe that he knew a way to get his furs through to the Hudson's Bay people, just let them wait and see.

What a light it would have thrown on the old trading company's methods and morals to have seen the answer to that letter! I would willingly have searched all night for it by candle light, but a second and more insistent call for supper came, and Romance went glimmering like a will-o'-the-wisp.

It was a highly hurried and unsatisfying supper. One retired farmer from Iowa was about to sell the John Jacob Astor House to another Iowa farmer who was going to retire and turn boniface. They were celebrating the transfer by a dance in the newly-floored ballroom, which was also to be the dining-room. And so I wolfed a hasty meal in the kitchen with old and new proprietor, who talked much of

tourist prospects and rates and took little more than hostile notice of my plaintive queries anent the working of the old "bull-wheel" hoist and the disposal of the old post records.

The retiring owner did stop for a moment to tell me about a walled-up door to one of the crypts beneath the ancient walls, and of how he had always intended to break through and see what was behind it. That was as far as he had got with the story when the new proprietor interrupted to say that the guests were arriving for the dance and the orchestra was worried because the saxophone player had not yet appeared.

Just why the Michigan Historical Society, which has done such fine work in the preservation of old Fort Mackinac, has not intervened to save the historic records of the Astor post I had no chance to learn.

When I slid back the Coast Guard station door and looked out the next morning at daybreak, it was to find not only the bay enjoying its wonted calm but a clear expanse of water to north and south as well. A barometer that had continued to fall rapidly during the night still warned of a major disturbance in the offing, but that there was at least a lull in the storm sufficient to allow me to make my projected dash for the shelter of "The Snows" became evident as the light strengthened and revealed an almost dead calm as far as the eye could reach.

Without wasting time in further hesitation, I slid

my boat quietly down into the water and, in order not to wake my sleeping friends at the station with a popping engine, started out of the harbor under oars. Passing the stern of a steamer at the next dock south, a pajama-clad figure came to the rail and beckoned me near for a parting warning. This was Captain Goodreau, a brother of the fisherman I had met at Manistique, and who had been rumored lost with his launch in the storm which had caught me off Naubinway and driven me in across the reefs.

Captain Goodreau was a veteran lake skipper, and in conversation with him the previous day he had been very emphatic in urging me to keep port while the weather was in its present unsettled condition. Now he reiterated this warning, saying that all indications were for one of the worst storms of years to break within the next day or two. Seeing that I was already started, however, he thought there would be no great risk in running across to "The Snows." From there on I must keep inside of the islands for just as far as I could, and when the last of these was passed, never get more than a mile or two from land.

Captain Goodreau's final warning was one which stood me in good stead for many a day. I have since thought, indeed, that it might well be taken as the one most vital direction for the man who navigates the Great Lakes in a small boat, and especially for the one who—on account of limited time or for any other



STATUE OF PERE MARQUETTE AT MACKINAC

reason—finds it necessary to take chances in making his mileage between storm and storm, or even scudding between the head and tail of squall and squall.

“Don’t bother too much about general barometric readings,” said the veteran, leaning over the rail and drawing his bath-robe closer against the clinging lapplings of the morning vapors. “Watch the clouds. You can always tell when there’s dynamite in the banks to windward. When you see these banks making and rising, never get far from land. But don’t bother about them until the fingers of vapor that shoot out ahead get directly above you. If they dissolve there, hold to your course. The main storm will not follow them. But when these fingers pass beyond the zenith and begin to broaden, make for shelter while the going’s good. You can be sure the big stuff is going to follow, and that it will always be too heavy for an open boat to ride out.”

If every sailing yacht or motor cruiser navigator of the Great Lakes will learn that one direction, and how to interpret it, he not only can avoid being caught unprepared in open water, but—what is scarcely less to his advantage—keep from holding to harbor many a day when he might just as well have been on his way.

Thanking my keen and kindly old adviser, I started the motor and ran out between the flanking buoys into the northern channel of the Straits of Mackinac. I was again on the track of the *voyageurs*, though it is

probable that the most of them, with their light canoes, preferred to play safe by hugging the mainland all the way round to St. Ignace. Thus began one of the most interesting and exhilarating runs I ever made in a small boat upon any lake or river—interesting because of the historic and beautiful waters through which my way led, exhilarating because the whole ninety miles of it was made under the menace of a hair-hung sword which never fell. Though a storm of incomparably greater violence than that which had so nearly brought my cruise to an end among the reefs of northern Lake Michigan was mustering its destructive forces to the south and west, preparing to make a clean sweep of the lakes, even the scouting vanguards never quite closed in upon me. Where I had guessed wrong in getting caught off-shore in Lake Michigan, this time I guessed right, and thereby avoided more than a searing splash or two of the hell-broth a-brew to south'ard. Hence the thrill of zest and satisfaction which lingers even in the memory of an unforgettable day.

The twelve-mile open-water traverse was over in a little more than an hour. Steering north-east by compass until the loom of Brulee and Coats Points (flanking the West Entrance to "The Snows" to north and south respectively) fixed their positions beyond doubt, I ran straight ahead into the closely-landlocked waters of Marquette Bay before shutting

off the motor and drifting while I ate a breakfast of eggs and cocoa prepared on my diminutive "canned-heat" stove.

Weather worries were over for the next three or four hours, for the thickly-planted "Snows" crowded upon the narrow zigzag channels like the half-closed teeth of a wolf-trap. Only by keeping a close eye on my large-scale chart was it possible to avoid running into the innumerable blind inlets opening on every hand. Even as it was I must have traversed twice or thrice the length of the direct east-by-north course to Detour Passage, but the way I took was extremely beautiful and very safe, either of which considerations would have warranted following it.

The small group of Les Cheneaux is the only American section of the Great Lakes comparable for insular beauty to the wonderful "Thirty Thousand Island" waters of Georgian Bay, toward which I was now headed. "The Snows" are studded thickly with summer homes, clubs and hotels, all of which I found in active state of reconditioning for the imminent vacation season. The advance guards of guides, boatmen and servants were the predominating element, all highly friendly, especially in the matter of beckoning in a water vagabond to a seat at innumerable appetizing breakfasts, which flooded the narrow channel with the savory fumes of steaming coffee and frying bacon. Ready to stow a breakfast a mile

after my early start and the invigorating run in the snappy morning air, the necessity of keeping moving while the going was good held me inflexibly to my course down mid-channel after pantomiming thanks and regrets with a wave of the hand and a drooping shake of the head.

Reaching Muscallonge Bay, to the west of Marquette Island, the open waters of the lake again became visible through the narrow passage of the Middle Entrance. Heeding the reiterated injunctions to keep under cover, I put aside the temptation to save time and distance by the more direct and more open course and doubled the north end of La Salle Island into Government Bay, the twenty-five to thirty-fathom soundings of which are the deepest of the completely land-locked waters of "The Snows." Here again the lake lifted an inviting finger beyond the sprawling form of Boot Island, and once again I turned my back on the siren signal and sought security in the saw-tooth channels separating Government, Coryell and Hill Islands and the attenuated sliver of Island Number Eight.

Nosing into the restricted channel leading to Scammons Harbor, I became aware of a thickening blur of brown completely closing the way. Puzzled by the appearance of what I took to be shoals in a channel charted as deep and open, I ran on cautiously at half-speed, to find my advance blocked by a raft of

logs, extending unbrokenly from island to island. A disabled tug moored against the right bank told the story. Deprived of its way, the raft had swung broadside until its head had grounded on Government Island and its tail on Island Number Eight.

A hearty voice, booming through a megaphone from the tug, expressed regret over the traffic jam. They hoped to have the engine kicking in a few minutes, however, it added, and if I would run across to the other side there ought to be enough clear water opening up to let me through.

A spatter of fleecy steam-tufts from the tug, followed by a series of sharp toots, informed me that the head of the raft was being swung. So much of this motion was absorbed in the loose mass of the logs that it was all of two or three minutes before the tail began to edge away from the sharply shelving beach. Running into the opening as soon as there was room enough to use the oars, I was perhaps two-thirds of the way past the end of the encircling boom, when the tug spat forth another series of toots, this time high-keyed and insistent, like the warning of a locomotive to an auto driver who has failed to "Stop, Look and Listen."

Correctly interpreting this later signal as an attempt to apprise me that the engines had gone wrong again, I swung hard on my oars in a very serious endeavor to carry the boat clear of the jaws of the trap

that began closing upon it as the raft started swinging broadside again. When the banging of oar-tips against logs to port and shingle to starboard put an end to progress by rowing, I lost no time in scrambling onto the boom and trying to run the boat out of the narrowing strip of green water by towing.

There was still fifty yards to go when the slowly but relentlessly moving boom jammed my trim little craft against the beach and made further towing impossible. When, principally because I could not get the footing for a steady heave, an attempt to lift it out on the logs failed, I gave up the fight and waited to see the pretty shallop crushed against the pebbles as a peanut shell flattens under a brogan. This made the surprise all the pleasanter when, instead of grinding the boat to matchwood as I had expected, the logs simply shouldered it out upon the slippery shingle as gently as, and far more expeditiously than it could have been done by hand. A seed popping out of a squeezed lemon could not have moved more smoothly.

That was another landing made possible by a tilting outboard motor. The propeller of an inboard would have been driven through the pebbles and almost certainly injured beyond all hope of repair.

A few minutes after another toot, this time of reassurance, had told the tug was functioning again, the water-lane opened up and I towed my hastily-launched boat beyond further menace. I was heart-

ily rejoiced to be in open water once more. Gratifying as that providential shoving up the beach had been, I was not anxious to have it resorted to again, especially as a slightly sharper slope to the shore or the presence of a rock or two might well have encouraged my spirited little skiff to brace itself and offer resistance to the Juggernaut advance of that floating forest of pine. It was a strong little boat as boats go, but never intended to pit its strength against a half-mile of logs driven by a wind-pushed Great Lakes tide.

A sharp loop around the northern end of Coryell Island brought the open lake again into the picture, this time through the broad, straight Middle Entrance. The Captain of the Mackinac Coast Guard station had marked me a more conservative course inside of Strong Island, but it had the disadvantage of continuing the circuitous zigzaggings which had already cut down my easting so materially. With the sky still clear overhead and the open water still calm and unruffled, it seemed that the time had come to leave off sight-seeing and accelerate progress toward Detour, at which port I had planned to tie up for the night. So, leaving Strong Island to port and Gravelly Island to starboard, out I went.

With the barrier of "The Snows" removed there was a clear horizon across Huron, and I saw for the first time the malignant mass of sooty cloud smeared

along the southern skies like the smoke-pall of a great forest-fire. Masked lightning flashes shot in shimmering lines behind the vaporous mass, with barbed darts of fire breaking through above and glinting like the spears of an advancing phalanx. Sinuous spirals and tormented coils of streaming nimbus kept boiling upward, but ever to tumble back into the caldron from which they sprung. That was the one reassuring element of the situation. The predatory horde was halted in its march, probably waiting for the winged word from the higher command before charging into the area of lowest barometer where it could do the most harm.

The satiny sheen of the sallow-green water was underrun by a pulse of long swell which gained its momentum from winds as yet unfelt along the north coast of the lake. Apparently quite clear and unclouded, the water was still lacking in the clear crystallinity which had characterized that of Lake Michigan. Captain Goodreau had mentioned this differentiation in warning that I would henceforth have to keep a sharper lookout for shoals.

Little things like that have to be learned by experience, of course, and I received my lesson at Surveyors Reef, just outside the East Entrance. With no breaking seas to give warning, and only the scantest change of color, I ran from eighty fathoms of water

to a bare one foot in less than three hundred yards. It was, indeed, the actual uncovering of a rock in the trough of a wave rather than a brightening green that told me I was in the shallows, and I shut off and tilted my engine just in time to avoid the sharp barely submerged ledge onto which I was heading. That little scare was just what was needed. A more careful study of the chart and a closer watch ahead kept me out of serious trouble from shoals for most of the rest of the day.

The coast for two or three miles to lakeward was plastered almost solid with shoals. Farther out they were plentiful but more scattering. With the cloud-hosts to the south still marking time, I had no hesitancy in laying my course through the clearer water. I was running dead to eastward now, and it was wonderful going—smooth and even like tearing silk.

Whitefish and Beaver Tail Points with their deeply indented sprawling bays dropped rapidly astern. At noon I was abreast St. Vital Point, with the light-houses flanking Detour Passage looming straight ahead. Even without a chart one could not have mistaken the important traffic lane by which practically all of Lake Superior's shipping plies to and from Huron and Michigan. The line of steamers in either direction was continuous, and at points with scarcely greater intervals than those between the units of a

battle fleet running in line-ahead. It was an impressive example of the magnitude of Great Lakes shipping.

Up to this time it had been my intention to run north through Detour Passage, on across Potaganissing Bay with its fantastically beautiful Harbor Island, and then easterly into the North Channel along the shore of Drummond, Cockburn and Mantoulin Islands to the entrance to Georgian Bay. This route, though somewhat circuitous, had been especially recommended because of the many protected stretches all along the way.

When noontime showed the long-expected storm no nearer breaking than in the morning, I decided to save the forty or fifty miles that would result from standing on straight along the southern shore of Drummond Island and into the North Channel by False Detour Passage rather than following the course originally laid out. The chart showed a villainous barrier of reefs all along the south coast of Drummond, but, by way of compensation, several well-protected harbors into which to run for shelter. By keeping two or three miles off-shore I would miss the worst of the shoals, and still not be too far off to beat bad weather to a place of refuge.

I was not more than half way along the broken southern line of Drummond Island by mid-afternoon. Progress had been a good deal slower than I had

anticipated, due partly to a freshening headwind, but principally to the fact that the reefs were far more extensive than the small-scale chart by which I was now running had led me to believe. Rocks kept cropping up out of the water several miles from land, especially at the extensive Holdridge Shoal, the soundings of which were not given on my chart. The submergence of the sun in the now aspiring south-westerly cloud-bank threw a somber light upon the waters by which it was more difficult than ever to detect indications of shoaling. To play safe, therefore, there was nothing to do but shut off the engine when nearing exposed rocks and proceed under oars until there was no further doubt of depth.

The east-south-easterly wind which had sprung up appeared to have no connection whatever with the main artillery massing to the south, but rather to be a local afternoon breeze that was snatching the opportunity to blow while it had a clear field. It served a useful purpose in helping to reveal hidden shoals, but this was more than offset by the short, ugly cross-seas it kicked up to run athwart the course of the long swells from the south. This resulted in a crazily reeling, drunken-man sort of a progress that was neither swift nor comfortable.

When the clutching finger of vapor Captain Goodreau had mentioned began to claw zenith-ward from the camp of the cloud-cohorts at about the same time

an increasing rockiness of the coast threatened to make for difficult landing conditions, I began to get nervous. Reassurance came when the scouting streamers fluttered to tatters and melted to nothingness in the graying sky overhead, and reviving ebbing courage sufficiently to induce me to hold the boat on her slap-banging course toward the sheltered lee I expected to find in the narrow passage called False Detour.

Evidences of the treacherous nature of the coast had been cropping up ever since I came abreast of Drummond Island. I was rarely out of sight of a stranded wreck from the time I sighted the first one—the skeleton of a large steel steamer—beyond Island Harbor. Several of these appeared to have been modern ships, but most were ancient wooden hulls, beaten to an almost silvery whiteness by summer rains and the batterings of winter ice.

Wrecks are only picturesque from the land side or the vantage of the deck of an unmenaced steamer. When one is skating along the edge of foul water and foul weather in a craft that is a possible candidate for initiation into the ghostly, ghastly brotherhood, old hulks are just about as cheering and picturesque as a skull and crossbones.

The sight of a little lumber steamer disappearing into a narrow inlet a couple of miles ahead was highly heartening at this juncture. Assuming that she was

headed into False Detour, reached an hour sooner than expected, I promptly turned into the widening wake and tagged along after. That highly intelligent piece of navigation took me well into Scammon Cove, with a net loss of six miles of distance and forty minutes of time.

There was no mistaking False Detour Passage when I finally came abreast of it an hour later. Clear, deep water stretched unbrokenly through to the wide North Channel which I was striving to reach. The gradual altering of my course from east to north-east brought the wind abeam, and then on the starboard quarter. The seas grew sharper and steeper for a mile, doubtless due to the slight current from the Superior drainage meeting the wind from Huron in shoaling water. Then the surface smoothed as I closed in and made a lee of the high rounded hills of Cockburn Island, which flanks the passage to the south.

A clearing on the upper slope of lofty McQuaig's Hill and the scar of an occasional logging road were the only man-made marks visible as I coasted the rocky shore of Cockburn Island, looking for a possible camp or settlement. The chart indicated Tolmansville, at the north-eastern corner, as the only port on the island, but night was approaching now, and with it the ominous cloud-bank from the south. Ready to make any port in a storm, I was still anxious

to reach a point where there was better protection from the imminent onslaught than could be found upon the open beach. And so, with the waters darkening through clouded violet to purple-black, I held on through the charged, humid twilight, lapped in coiling, writhing airs, for the still distant harbor.

Once, drifting while refilling the gasoline tank, human voices came to me across the water, and presently I descried a large boat gliding through the shadows of a jutting point toward the mouth of a rocky inlet. A half dozen men—lumber-jacks, doubtless—were rowing, and singing as they rowed. I could catch the rhythmic throb of the song, but not the words. And so that left me free to fancy they were singing the incomparable “Canadian Boat Song.” Timing them to the flash of the distant oars, I hummed the hauntingly beautiful words while the last of the day’s sixth filling ran tinklingly into the tank.

“Listen to me, as when ye heard our father
 Sing long ago the songs of other shores;
 Listen to me, and then in chorus gather
 All your deep voices, as ye pull your oars. . . .
 From the lone shieling of the misty island
 Mountains divide us, and the waste of seas—
 Yet still the blood is strong, the heart is Highland,
 As we in dreams behold the Hebrides.”

The song, of course, was probably never sung at all by real boatmen save in Gaelic; yet English verse

knows nothing more liltingly beautiful than the translation, the very authorship of which is in some doubt.

Trying to follow the boat and the song into the inlet, where I felt sure there must be a safe and comfortable camp, I found the way blocked by a reefy barrier so beset with rocks that threading it in the failing light was out of the question. That left no alternative but to stand around the north end of the island to Tolmansville, which friendly little port I reached just as the curtain of darkness was dropping its last dusky flap.

A dozen hands reached from the rickety old lumber dock to catch my flung painter, and a few minutes later I was snugly moored alongside a stanch fishing launch. And not until I had stepped ashore into Canada did it occur to me that I had been specially cautioned in Mackinac not to fail to land at Detour and have clearance papers made out in proper shape before venturing over the line. Just how enormous an offense I had committed in the eyes of International Law I had no idea, but visions of at least a heavy fine were in my mind as I headed for the Custom-house to make a clean breast of the affair, with the possibility of the still more serious punishment of deportation for disciplining at the hands of my own Government.

The Customs Officer was milking his cows when I presented myself at his office, and so I took the occa-

sion to curry what favor I could with the powers that were by helping his wife at the cream separator. Easing a tired back at the handle of a separator had never failed me before, though I had to confess to myself that it had never been tried with anything comparable to a sentence for an offense against the Laws of Nations at stake.

But the old sure-fire stuff was as good as ever, as the sequel proved. The Customs man, when he came with the last fragrant bucket of milk to pour into the shining tank of the separator, simply clapped me on the back, took the handle and ordered me to run over to Mrs. Pateman's for supper.

"Pauline Pateman runs the boarding house, you know," he added by way of explanation. "We sent word over for her to prepare for a stranger as soon as we heard that smart little motor of yours popping round the point. If I don't miss my guess, Pauline will have something rather tasty waiting for you. Heard firing in the woods this afternoon, and the chances are that Jim has been attacked by the deer again."

Grinning at this cryptic remark, His Majesty's Royal Customs official bent over the handle of the separator, leaving me free to walk out through the gate with a clear name. He had not even asked me for the name of my boat, a fortunate circumstance in view of the fact that she did not have any—just yet.



A RAFT WHICH BLOCKED A WHOLE CHANNEL



FRESH FISH FOR LUNCHEON

CHAPTER IX

DOWN THE GREAT NORTH CHANNEL

Pauline Pateman was the widow of a lumber-jack killed in a log-jam the previous year. Her little guest-house was as prim and pretty as its fair mistress. And the savor and sight of that waiting supper strum the chords of gustatory memory to this day. Prepared in the brief half hour that had elapsed since my boat had rounded the westerly point of the bay, it amply bore out the claim of the youngster who guided me cross-lots to the gate at the head of the hollyhock- and petunia-bordered walk.

"Polly Pateman is as good a cooker as she is a looker," he had assured me; and—there was Polly curtsying and dimpling welcome at the door, and there was the supper steaming and sizzling welcome from the kitchen. Hot scones and sweet clover comb-honey! Mushroom omelette! Baked whitefish! Wild strawberries and cream thick enough to spread with a knife! Apple pie with a crust so tender that it almost faded away before one's gasp of anticipation! Caviar, from a sturgeon netted in the bay! And—oh, yes, the Customs Collector had surmised aright when he reckoned that "Jim had been attacked by the deer again." Polly confessed she had learned

that trick of larding a haunch of venison in countless tiny slits from a French-Canadian guide.

Presently, when it was clear that I had really come from the other side of the boundary beyond all reasonable doubt, I was informed of the "deer menace." Ontario had very strict game-laws, it appeared, but in the case of moose, deer and other horned animals capable, when enraged, of doing grievous bodily injury, there had always been a very liberal interpretation in favor of the hunter forced to kill one in defense of his life.

With the burden of proof up to the wardens, there was no need for a man to take undue chances in waiting to stop with a bullet the charge of an infuriated bull or buck. And as the deer of Cockburn and Mantoulin Islands had an especially sinister reputation for attacking unprovoked and without warning, it was not considered safe to venture far from the main-traveled roads unarmed.

It also appeared that some men were more liable to unprovoked attack than others, and among those most susceptible locally was "Long Jim" McPherson. Jim, who boarded with Polly when work was slack in the logging camps, lounged by the fire, cleaning his battered old Winchester the while, and told of the Damoclean threat that ever seemed to hang over him in the woods. He was always being rushed unex-

pectedly, he said, and especially in the summer. This made it particularly dangerous, because bucks' horns, like oysters, are likely to be poisonous in the months without an "r." And so he wouldn't take no chances; not he. And of course good meat couldn't be wasted. And so . . . "Long Jim" spread his hands with a "What-would-you?" gesture and grinned across to where I was just wolfing my third helping of Polly's larded haunch of venison.

What a supper that was after my long day on the lake! And how priceless the hour that followed, with Jim and me swapping yarns about stopping wild animals in full charge with our unerring rifles, and fair Polly pausing in her dish-washing to regard now one and now the other with half-twinkling, half-wondering eyes, puzzled to know which was drawing the longer bow!

Polly had prepared me a room as fresh and fragrant as the perfume of lilac bloom welling in through the open windows, but Prudence jogged my elbow to warn that it would not be wise to sleep a quarter of a mile from my boat on a night when conflicting wind-gusts scuffling in the street told that the skirmishing vanguards of the storm which had menaced from the south all afternoon were massing for attack. Jim, striding confidently through the impenetrable pall of the darkness, guided me back to the tottering wharf.

Remarking that the air was as "stripèd as a she-skunk," he reckoned that it would be behaving just as ornery before morning.

The "streakiness" of the atmosphere was indeed remarkable. One moment the perspiration started to your brow as it was lapped by a humid stream of air that might have been simmering in the caldron of the tropics; the next your face was lashed by an aërial icicle chill enough to have tumbled from the eaves of the roof of the Arctic. Anon you were buffeted by whirling dervishes of dust-devils formed where the two met and mingled and wrestled for mastery to the accompaniment of shrieks and snarls of frenzied effort. One had the feeling of being shouldered in the dark by a milling mob of ruffians, an apprehension that he might be sand-bagged or slugged from behind at every turn.

Jim lent a hand to do what was possible in rigging fenders and running extra mooring lines for the boat before leaving me to spread my bed in the rickety warehouse at the landward end of the wharf. Dozing off twice whilst blowing up my air-mattress, Morpheus had both arms round my unprotesting form before I was well inside the covers. Few things in life are sweeter than the sleep that is induced by clean hard work and lungs fanned full of wind driven ozone.

Proof against the earnest efforts of sound and motion to break the strangle-hold of the Sleep God, I



LUMBER RAFT IN GEORGIAN BAY

was awakened at long last by the shock of cold—very cold—water. My shelter was wallowing like a ship in a gale—a doomed ship on the verge of foundering at that. Not only was it rolling rails under at every surge, but it was also leaking like a sieve. Indeed, that simile falls far short of doing justice to the situation. A sieve leaks only through the bottom, whereas that old warehouse was taking water impartially through its floor, roof and sides. When a momentarily bared patch of starry sky, glimpsed through the disintegrating shingles, revealed this triple cataclysm as having its fount in the lake rather than the heavens, I had fair measure of the force and fervor of the bit of aërial Donnybrook raging without.

Not doubting that the ramshackle structure was about to be tossed lakeward if not heavenward on the horns of a wild bull of a tornado, I shamelessly turned tail on bed and boat and bolted for *terra firma*. My bowed head butted almost as thwackingly against the wind as upon some part of the frame of the broken door, and my heart went into my mouth as a lightning flash revealed the upper air peppered thickly with fragments of wreckage, whirling like autumn leaves.

Reassurance came with the realization that the stone jetty was still on an even keel and the discovery of the fact that the aspiring whorl of storm-tossed wood was principally composed of light and comparatively innocuous shingles from the ancient sawmill.

My oozing courage ebbed back quickly enough once I was clear of the primal chaos inside the shattered warehouse, but it was not equal to going out on the exposed end of what I still believed to be a wrecked wharf until Captain McKay and his crew came down to lead the way with a lantern.

Admitting that it was "a nasty bit of a blow," the veteran Scotch fisherman said that he had known the old wharf to weather many another just as bad and that he had no great fear for the safety of his tug.

Although the prevailing gusts appeared to be coming from the south across the island, there was a heavy sea running in from the bay. Water from waves pounding under the warehouse dashed about our knees as we pushed across the bulging planking. This was nothing, however, to the solid green water that was washing right over the top of the open wharf beyond. The hump of the hard-running waves was broken every few feet by a jet shot up through the hole where a plank was missing. This, with the blinding spray, made night navigation difficult. McKay and his French-Canadians, broken to reeling decks, seemed to manage to stumble on more or less upright; my own progress was largely on hands and knees.

Reinforced again and again through the years, the old wharf was an almost solid mass of timbers, both above and below water. This formed a fairly well

protected lee as long as the structure stood. McKay's big tug, skillfully and heavily moored, proved to be riding quite comfortably. A smaller launch, against which my own boat was secured, appeared to be about to break away, however. As this would have meant the almost instant destruction of both craft as soon as they drifted out of the lee of the wharf, there was nothing for me to do but to cast off and try to find a better berth before the odds became prohibitive.

While McKay and his men worked to secure the launch, I reefed the canvas cover of my boat, shipped the oars and stood-by to run for the shore as soon as the lantern could be spared to find a landing place. It is always awkward working in the dark in a banging boat, and here there was no end of a mess due to the fact that the water dashing over the top of the wharf threatened to swamp the craft as the protecting canvas cover was rolled back to give rowing room.

Fortunately McKay was ready to cast me off before the menace from the flood became serious. My painter parted even as they let it go, while the stern-line, as I discovered later, had chafed down to its last strand. My pounding boat would have been adrift on its own in another five minutes.

As soon as the lantern twinkled to landward, I swung the boat's nose in line with it and headed toward what I dimly recalled as a bank built out from the sawmill with slabs and sawdust. The wind got

under the loosely furled hood as I passed out of the lee of the wharf and, billowing it into a yawing balloon of canvas, drove the boat at a wild wallow before it. The best I could do was to hold the stern to the wind and keep from striking beam-on.

With headway unchecked, the bow hit the crumbling wall with the force of a battering ram. Already undermined by the pounding waves, the overhanging mass of rotten wood gave way at the blow and caved down to bury the bow all the way back to the sprayhood. This released an ancient pocket of dry dirt and sawdust which, caught by the wind, was whirled about in a blinding shower. Although the humor of it escaped me at the time, it was really rather funny, that getting "all dusty" at a moment the air was almost solid with driving spray.

With its nose held in a vise by the cave-in, the stern could not rise to the waves, and so there was nothing to prevent the water driving in and filling most of the boat not already choked with débris. My poor little Elto was, of course, completely submerged. Flying water laid the dust quickly; indeed, it took a hard-flipped wave crest effectually to clear my eyes and allow me to orientate sufficiently to abandon ship to landward rather than lakeward.

Mackay and his men were already burrowing down to the buried bow as I clambered out beside them, and once a place to stand was cleared it was the matter of

but a few moments to work the boat above the rotten slabs and drag it back away from the encroaching waves. Dumping out the worst of the dirt and water, we made fast the canvas cover again and left her for the night.

A half hour's further work on the wharf did all that was possible for the launch and tug. Then, on Captain McKay's invitation, I carried my wet bed over to the bunk-house occupied by his crew and turned in under a tight roof after quaffing a steaming mug of hot cider. The last I remember was the spatter of blown spray on the windward panes and old Pierre, the mate of the tug, trying to play a mouth organ and recite "*Ze night was black like one black cat*" at the same time.

Some time before morning a change came over the spirit of the weather. Daylight found it still stormy, but the cyclonic conditions had given way to a hard but not violent northerly gale. The harbor was scarred with irregular lines of converging seas, while the open North Channel was beaten white to the broken horizon. With an empty lake proving that even steamers were keeping port, pushing on with my own frail shallop was not to be considered.

Captain McKay expressed the opinion that the heavy storm of the night was a far-flung kick of a great tornado, the center of which—if the cloud formations of the previous afternoon could be trusted—

was far to the south. That this diagnosis was substantially correct I was to learn several days later at Little Current, where the Toronto papers told of a cyclone, at its worst on Lake Erie and in northern Ohio, which had destroyed many millions of dollars worth of property and between two and three hundred lives. It was rated as by far the most destructive Great Lakes storm of recent years.

For the next three days the gale continued with little abatement. With my boat safe on the shore, I continued to sleep at Captain McKay's bunk-house and explore still further the inexhaustible resources of Polly Pateman's table. By way of diversion I took a couple of long walks across the island and went out once to help protect "Long Jim" from the attacks of a big moose which he said frequented a remote patch of woods he desired to cruise for cedar. Moose were particularly savage during northerly gales, according to Jim, and he didn't want to take undue chances of being surprised. Fortunately, we were not molested.

By July 1st, Dominion Day, the gale had blown itself out. The outer lake was free of white-caps for the first time since my arrival, four days previously. With thunder clouds massing to south and west, however, Captain Mackay recommended that I hang on until afternoon and await developments. The passage between Cockburn and Manitoulin Islands was

a notoriously treacherous bit of water and no chances should be taken in crossing it. So I went with the veteran in his tug to lift his neglected nets, untouched for several days on account of bad weather. "Lifts" of whitefish and lake trout aggregating over a ton in weight, and worth at current prices nearly five hundred dollars, more than compensated for nets badly torn by waves and driftwood. With anything like reasonable luck, the consistent fisherman of the northern lakes is in line for substantial profits.

The clouds were still rearing ominous fronts when we came back to the wharf, but as there appeared to be no probability of their making any punitive movements before the end of the afternoon, Captain McKay thought it would be best to push off as quickly as possible and get across to Manitoulin while the going was good. There were many harbors along the north coast of this hundred-miles-long island, he said, with occasional smaller islands not far off-shore. At the worst, I could dodge along from shelter to shelter between storms if the weather continued bad.

Launching and loading the boat and working the dirt and water out of my abused engine took until three o'clock, when most of the population of the pretty little village came down to speed me on my way. Polly and "Long Jim" both brought characteristic contributions. Polly's offering was a two-quart can of wild strawberries and cream; that of Jim

a by-product of an attack made upon him by a five-prong buck—"a hellish vicious brute"—while he was on his way to cruise for railroad sleeper timber. And so farewell to Cockburn Island and out into the lake. I had halted there four days. With the names of most of the people in my mind and some knowledge of the joys and sorrows of not a few, it was as though I had been there as many years.

Just as after its ignominious soaking in northern Lake Michigan, my engine was again splenetic and profane until the last of the extraneous matter had worked out of its system. For a mile or two the cylinders spat explosive oaths at each other between spells of sulking silences. Then their lungs were cleared of the irritating substances and the temperamental pair resumed their wonted purr of contentment.

Peace and power were restored opportunely, for the westerly point of Cockburn Island was now abeam to starboard, with the high, dark green hills of Manitoulin looming over the same bow. Between rolled the somber depths of Mississagi Straits, the waters agitated (as McKay had warned) with the conflicting currents from Lake Huron and the North Channel.

Under normal conditions the current of the strait is from north to south, as in Detour and False Detour Passages, the three carrying to Huron the most of the water draining from Superior by the Sault Ste. Marie. To-day, however, doubtless due to the great

storm which had swept the lakes to the south, a heavy swell and current were setting north from Huron, to meet, at the North Channel entrance of Mississagi Strait, a counter sea and current driven by a stiff breeze from the opposite direction. By an unfortunate chance, the battle ground of the opposing forces was directly across the only course which I could steer to reach the north coast of Manitoulin Island.

That was a lively passage from the outset, with a promise of becoming more so every moment as the thunder clouds banked higher in the north-west with their threat of throwing reinforcements and heavy artillery into a contest which was already waxing rougher than at least one inadvertent member of it had any desire for. For a mile out into the North Channel from the mouth of the strait the surface of the water was just one glorified tidal-rip—waves wallowing without rhythm or responsibility, wrangling savagely to see which could climb upon its neighbor's back or knock his feet out from under him. None of them seemed really to hold any grudge against the boat itself; at the same time they had no compunction about trampling it under foot if thereby they could grapple at each other's throats the readier. That made distinctly bad going, especially for an open boat.

It would have eased the situation materially to have been able to throttle down and run under a slowed en-

220 BY WATERWAYS TO GOTHAM

gine, but this I was afraid to do, except as a last resort, for fear of being carried into the open strait with the imminent breaking of the northerly squall. And so I barged along as best I could, taking water impartially over bow, stern and both sides and getting rid of it in intermittent fits of activity with the bailing bucket. I was frankly and unfeignedly relieved when the wooded heights of Meldrum Point, the northwesterly extremity of Manitoulin Island, interposed to cut off the wind-piled tide from the main lake and put an end to the tossings of the infernal rip off Mississagi Strait.

I now had the alternative of running in past Brittomart Point and seeking shelter in deeply indented Meldrum Bay or standing on along the north coast of Manitoulin as long as weather and daylight permitted. With the menace of the open strait removed, I plumped for the latter course. The bay would be on my lee in any event, and if the squall broke I had only to turn and run before it until a protecting cove was reached. It was quite a safe and conservative plan—in theory.

As though aware of my strategy, the generalissimo of the advancing cloud phalanxes coolly held his legions in leash until I had scudded almost all the way across the four-mile-wide entrance of the bay. Then, with only a tumble of rocky coast to leeward on the bay side of Point Chamberlain, he opened up with all

his guns. With landing quite out of the question along any of the shore in sight, there was nothing to do but to stand on round the point and hope for something better beyond.

A good deal of action was crowded into the next twenty minutes. With the wind and seas on my port beam, it was a rough-and-rowdy fight all the way to the point. The chart had warned me of a long lake-ward reef off Chamberlain and I had tried to lay a course far enough out to give the end of it a safe berth. Due, doubtless, to a greater leeway than I had allowed for, I found myself driving straight into a long patch of breaking waters masking the shoals beyond the end of the point. To avoid this I had to turn right out and head into the teeth of the blustering squall.

Water came in faster than I could get rid of it for a few minutes, but I made up for lost time with the bailing bucket once I was round the point and headed back toward shore. With the wind on my port quarter, and finally dead astern, the spray-hood acted as a sail and the boat drove in at a clip which quickly carried it to the outermost line of rapidly mounting breakers pounding along the rocky shore.

As the boat was still taking water faster than I could throw it overboard, the only thing left to do was to attempt a landing before it swamped. With the center of the squall not over a mile away, there was now no time to coast along for a more favorable spot.

Although the shore was less abrupt than on the other side of the point, nothing like a sheltered cove appeared to open up within eyescope in either direction. Nor was there anything even suggesting a sandy beach in sight. The shore was a series of sand-stone ledges covered with slabs and fragments of loose rock. The broken character of the surf indicated that deep water alternated with shoals, with rocks peppered thickly all along the inner lines near the beach.

Taught by my experience on the north coast of Lake Michigan the utter impossibility of running a heavy surf with a boat of low freeboard without swamping, I had already given some thought as to how to manage at the next emergency. Tilting the engine and backing in slowly had seemed the most promising plan to follow, a system somewhat comparable to that we had used in running the rapids of the Grand Canyon of the Colorado the previous summer. This, I reckoned, would not only give an opportunity for better observation, but would also minimize the chance of swamping through presenting the decked over bow rather than the open stern to the intrushing waves.

With one place looking as bad as another for rocks, I simply let the boat drift on as it was driving before the waves, trusting to luck and hard-plied oars to avoid obstacles as they developed. We rode the outer lines of surf very buoyantly, taking but little

water. I had no trouble in keeping the bow to the rollers in deep water, but when I had to check headway and pull quarteringly to prevent driving onto a half uncovered shoal it was touch-and-go to keep from being swung broadside.

This happened three times, with the last a really near squeeze from being turned and rolled across a patch of barely submerged rocks. Snapping off an oar by throwing too much weight on it, a second was shipped barely in time to swing the bow back to meet the next wave. Then I nipped into the lee inside of the rock-patch and had quieter going on to where the half-spent breakers were throwing their dying efforts against the ledges which formed the shore.

Heading for the broadest break in the rocky shelf, I backed slowly in, checking the stern-way of the boat to minimize the force of its final impact. Rolling out as the shoaling water put an end to the usefulness of the oars, I grasped the starboard gunwale and ran the lightened boat inward until, lifting with a wave, it came down and grounded solidly on the rock. Steadying it here until two or three more breakers had spent themselves harmlessly over the bow, I unclamped the engine and, watching for a favorable opportunity between waves, ran in and deposited it on the shore. Gasoline, grub-boxes and bed-roll followed, after which I was able to drag the boat in another ten feet. Here, with the stern out of water and the bow barely

splashed by the expiring breakers, I wedged it on an even keel with logs and left it secure against anything but the banging of a protracted norther.

I was no more pleased over getting out of what was becoming an uncomfortable situation than I was over having worked out a plan by which I could land my fifteen hundred pounds and more of boat, engine and outfit single-handed through the breakers on a rocky shore with comparative ease and safety. The miserable mess-up of my landing on the north shore of Lake Michigan need not, I told myself, be repeated if only I used reasonable judgment in getting started shoreward in time and had reasonable luck in the matter of unforeseeable contingencies. Not a little of my lost confidence came surging back again, but not enough, fortunately, to set me tempting Providence again by taking undue chances.

It was not until all had been made snug with the boat for the night and the last of the squall had gone thundering down leeward that I discovered that my haphazard landing had brought me right into the heart of a veritable sylvan paradise. The forest front was a line of budding birches that might have been lifted bodily from the canvas of Corot or Diaz. Under the trees was a dewy greensward carpeted thick with blossoming daisies. Farther back was a bank of somber cedars, almost masking a cliff and a gay little waterfall that tumbled down to a fern-fringed pool.

It was the sort of a place which one never finds by deliberate search, but has to be dropped into from an airplane, or blown to it as I had been.

A pair of deer jumped up and scampered back into the forest as I started gathering firewood along the shore, and when I went to look at their tracks I found larger and deeper prints which indicated that a hulking bull moose had been on watch there within the hour, possibly at the time of my landing.

Setting alight a hundred-cord pile of driftwood as the twilight shadows lengthened, I built a fireplace from rock-slabs on the beach wherein to barbecue "Long Jim's" parting gift, a haunch of venison. This would have been a half-day operation ordinarily, but with the coals from the roaring driftwood fire to draw upon the joint was done to a dark brown turn in a couple of hours. Pauline Pateman's can of strawberries and cream, cooled in the icy pool beneath the waterfall, furnished a delectable dessert.

What a feast that was! And what a setting for a feast! The passing of the squall had cleared the heavens and the falling of the wind had allowed the lake to settle back to one of its rare spells of placidity. The reflected lake-stars blinked languidly back at the sky-stars as the darkness deepened, while far across the North Channel a locomotive puffing along the mainland of Ontario plowed the sky with shafts from its headlight. From north-east and north-west bea-

cons on shoals or islands threw tremulous gleams across the slowly heaving waters, and once the blurred block of lights of a passenger steamer teetered along the edge of the horizon.

My big camp-fire, reflected in pool and lake and in rose-tinged shaft of the waterfall, roared skyward for an hour before dying down to a heap of dulling embers. Fire-flies fluttered up as I spread my bed among the daisies, darting off through the birches to lace the air with golden wires. Later, when the big fire was quite dead, other lights flashed out to join the dance of the fire-flies. These were vitreously green and always marched in pairs. Some of these belonged to deer, I told myself drowsily, and maybe some of them belonged to moose.

When a pair of sharper, brighter eyes appeared, I thought of wolves and bears and started to reach for my ax. Then, remembering that the lower animals could be cowed by the power of the human eye, I began systematically staring down the lurking enemy. But either my own eyes or those which I sought to cow would not behave according to rule. I felt the gleaming pools of terror drawing nearer and nearer, burning me with their heat. Seizing my ax as a last resort, I aimed a skull-crushing blow squarely between the nearing orbs of fire.

Cleaving through empty air, the keen blade buried itself among the daisies. I had miscalculated the dis-

tance and struck too soon. Probably the error will stand as one of the greatest on record. By how much I had missed my mark I did not realize until, shocked broad awake, I sat up and found myself blinking into the eye of the newly risen sun. Ninety-five million miles is a real miss, especially when using a hand-to-hand weapon like the ax.

Anxious to reach the sheltered islands of Georgian Bay before another storm blew up, I breakfasted hurriedly and pushed off into smooth waters that glittered like a golden mirror in the slanting light of the morning sun. With my Elto running like a top, I headed easterly between the picturesque Vidal Islands and the broad open bay of the same name. Occasional reef and shallows were indicated along my north-easterly course to Cape Robert, but these were not nearly so menacing as the infernal nests of rocks through which I had navigated in northern Lake Michigan and on the run from Mackinac to Cockburn Island.

Standing due east from Cape Robert, I traversed the wide mouth of Bayfield Sound, coasted Barrie Island and headed across Julia Bay to the light on Janet Head. The little town of Gore Bay, straggling over a steep, green hillside, beckoned me in for lunch but I thought it best to save time by munching crackers and venison in the boat without shutting off the engine. An hour later a big moose, swimming di-

rectly across my course, offered more serious temptation. It would have been a glorious game to have roped him and had a tow. Knowing from previous experience, however, that there was no certain way of making him tow in my direction, I contented myself with the friendly hail of one passing voyageur to another and ran on toward where Clapperton and a number of smaller islands closed the mouth of the wide North Channel. This marked the end of my open water navigation. From that point on there was shelter available at no great distance from my direct course practically all of the thousand miles or more which remained to be traversed before reaching New York.

But there is a difference between shelter directly upon one's shortest course and shelter which one must pursue a circuitous route to take advantage of. I had been tossed on the horns of this dilemma all the way from Milwaukee, and now, as I came out of the narrow reef-beset Clapperton Channel to the comparatively open waters of West Bay, I had to choose again between a shorter course and the safer one.

Directly across the open water, distant not over fifteen miles, the smokes of the Little Current saw-mills were being smeared across the heavens by a gusty north-easterly wind. To the north were the rolling thunder clouds from which the wind was com-



NEAR PORT AU BARIL, GEORGIAN BAY

ing, preparing for their regular afternoon sweep of the lake. On the direct traverse to Little Current one was certain to meet the squalls well toward the middle of the bay, five or six miles from the nearest land. Only by a roundabout course to the north, jumping a mile at a time from Clapperton, Amendroz, Bedford, Rous and several minor islands, could one keep in a more or less continuous lee.

As this sheltered course would have involved running twice or thrice the distance of the direct one, and in shoal water most of the way, the price of immunity struck me as being a bit high, especially as there was no certainty of encountering a heavy blow in any event. And so I headed straight across for the smokes of Little Current, to learn, as usual, that the longest way round is the shortest way out.

The storm, as I had anticipated, came to meet me at about the center of the bay, blotting out all of the eastern and northern coast line and islands in its swoop. As soon as I saw the extent of the force of the disturbance, I opened up the engine and ran at full speed for the lee of Bedford Island which, with its two hook-shaped southerly points, promised ample protection from any wind that might blow.

This brought me into head-on collision with the advancing forefront of the squall. As soon as it became evident that I could not run at enough speed to

make headway against the storm without swamping, I throttled down the engine and tried to stay where I was. When even this proved too wet, I was confronted with the alternative of throwing out a sea-anchor or turning and running for the north coast of Manitoulin. Not knowing just how much more wind was still in reserve to be loosed from the heart of the black smother of nimbus to the north-east, I decided upon the latter course as the safer, in that it would take me landward faster in the event the blow was a really heavy one.

Turning and running brought some relief from the continuous shower-bath to which I had been subjected while trying to buck the rising seas, but for the first mile or two the boat did just about as wild a bit of wallowing as she had done at the height of the big storm in Lake Michigan. The wind appeared to be easing a bit as we neared the coast, which encouraged me to attempt to hold on with the oars immediately beyond the outer line of the surf rather than to risk swamping in attempting a landing on a beach which was quite as rough and rocky as that which, with much less sea running, had kept my hands full in making the previous evening.

It took hard, steady pulling to counteract the shoreward drift for a while, but at the end of twenty minutes I was rewarded by a perceptible falling off of the

wind and finally by the paling of the north-easterly heavens which signalized the passing of the squall. An hour's run in smoothing waters under a clearing sky took me in to a snug mooring at one of the docks of the historic old post of Little Current.

CHAPTER X

GEORGIAN BAY AND TRENT CANAL

Sleeping on a divan kindly turned over to me in the office of the Trotter dock where I replenished my gasoline, I pushed off from Little Current at daybreak the following morning, that of July 3rd. Helped by the steady set of easterly current (the drainage of North Channel) which gives the picturesque little town its name, I was quickly out of the river-like strait and heading across the opener waters of Manitowaning Bay. The steamer course ran somewhat circuitously to the south of Heywood Island here, but by threading the shoals to the north I managed to save a mile or two of distance. This brought me abreast of the double lights at the south end of Badgely Island, with the open waters of Georgian Bay shimmering like a sheet of gray satin under its cloak of thinning silver mist.

My most direct course from here would have been a point or two south of east to the protecting bank of "The Thirty Thousand Islands," which buffers the eastern shore of Georgian Bay from end to end. After my experiences of the two previous days in the way of thunder squalls with a small boat, however, I was reluctant to put so many miles of unknown water

between myself and land. Also, I had been assured that a glimpse of Killarney in passing would be well worth the slight detour reaching it involved; and Killarney was located on an inlet at the extreme northern point of the bay.

The little town of Killarney, I had been told in *Little Current*, was unique in a number of respects. Although actually on the mainland, it was connected with the rest of the world neither by railway, highway, telephone nor telegraph. Not even was there an automobile in local use. The spaces left for roads were merely grassy lanes between the houses and small patches of cultivation. Every one of the several hundred people was either Irish or French-Canadian. There was but a single non-Catholic in the community, and he was a recent backslider who had fallen victim to a "Holy-roller" evangelist.

And such was Killarney as I found it, only infinitely more restful and alluring than the bald description reads. Heading north-easterly and skirting the shoal called Kokanongwi Shingle, I coasted George Island until I came to a little toy lighthouse which showed the way into a deep, narrow passage, walled with a weather-polished reddish rock which had the look of porphyry. A mile of winding among slender peninsulas and tiny islets brought me to a straight reach of channel lined on either side with white and green cottages perched picturesquely among the

rocks. With verdure surging down to the water's edge and the blue-green summits of the Cloche Mountains notching the distant skyline, the lovely strait with its sparkingly clean village might well have been an arm of the famous Irish lake from which it took its name. A bare-armed, bare-headed girl with a mane of red hair, pulling a skiff in the bow of which a pert yellow Irish terrier was planted like a figurehead, lent the culminating Hibernian touch.

One could have lingered long in Killarney, with profit to one's town-frayed nerves if nothing else. But with the daily bank of thunder-clouds already beginning to mass for their matutinal maneuvers, there was nothing to do but content myself with a half hour's stroll along the grassy lanes before pushing off to make what way I could while the sun shone. The friendly grocer at whose dock I tied up told me of a cabin on an island "right along the way" where I could take shelter if the weather turned bad. I never found it. With thirty thousand islands "right along the way," looking for something on one of them was comparable to searching for the proverbial needle in the haystack.

The chart showed that, by coasting eastward from Killarney, I could follow a completely land-locked passage called Collin's Inlet, which ran to the northward of Philip Edward Island for many miles. As this would carry me far off the direct course, I decided

to keep to the open water a few miles off the main mass of the coastal islands, running to the latter for shelter only in case of necessity.

Reefs and shallowly submerged rocks swarmed even in the open lake, but, with clear water and a bright sky overhead, these were easily seen and avoided. Running steadily without even shutting off the engine for lunch, I made rapid progress until the regular afternoon thunder storms began to unlimber their artillery along toward two o'clock. Weathering two squalls with no more than a wetting, I was quick to turn and run for shelter when a bituminous funnel of cloud came boring down with the apparent intention of blowing me out into the middle of the bay.

The chart showed two masses of small islands immediately to landward, one called "Sly Boots" and the other "The Chickens." Rather fancying the latter as a roosting place, I headed in to where they nestled in brown silhouette against the loftier looming forests of the mainland. At first it looked as though I was running in to ram an unbroken wall of bare rock. As I drove nearer, however, narrow openings began to appear, these resolving themselves presently into winding channels separating hundreds of tiny low islands.

Bumping into the main pillar of the squall while still in open water, the wind-whipped waves were piling into the boat at a rate that would have filled her in

a few minutes had it been maintained. Then I scudded like a frightened rabbit between the first outreaching fingers of rock, and almost instantly the weight of the waves was broken. By the time two or three lines of "Chickens" had been passed only the wind and rain told that the squall continued, and I was safely berthed against anything short of a cyclone. Indeed, the protection from the seas pounding outside was so complete that there was no real need of stopping at all. Tilting the engine to protect the propeller from the rocks, I worked the boat along under oars until the squall had passed and it was quiet enough to run outside again.

The red-brown rocks of "The Chickens" showed unmistakable evidences of glacial "scratches." Doubtless, in fact, all of "The Thirty Thousand Islands" were scoured out from the mother rock during the glacial movements of the Ice Age.

The name "Voyageur Channel" on the chart at a point which I came abreast of an hour after coming out from the refuge of "The Chickens" called my attention to the fact that I was now off the sprawling estuaries of historic French River, and therefore in water which had been plowed by the keels of the boats of practically all of the early explorers and travelers. In order to avoid the rapids of the St. Lawrence and Niagara and the circuitous route by Ontario, Erie and main Lake Huron, it was long the practice to work up



THE CASCADE RAPIDS ACROSS THE ST. LAWRENCE

the Ottawa from Montreal and reach Georgian Bay and the sheltered North Channel by way of Lake Nipissing and the French River. This was the main route to Superior, Michigan and—by Fox River and the Wisconsin—on to the Mississippi, for many years.

At five o'clock some brilliantly white spots which came up and sat upon the sunlit waters of the bay to the east turned out to be the Bustard Rocks Range Lights. As the north was threatening storm again, I was glad to take advantage of the shelter until the next flight of squalls blew over. Running into the harbor afforded by the passage between two tiny islands, I found the old lighthouse keeper and his wife awaiting me on the landing. With them was an officious personage in sporting togs, who promptly boarded and began to search the boat to the accompaniment of a running fire of questions as to whence I had come, what I had been doing and where I was going. At the end of twenty minutes he ceased his pawings among my outfit, stepped over into a smart little launch and pushed off without any explanation. He was evidently considerably put out about something.

As soon as the launch was out of the passage, the lighthouse keeper explained that the man was the Fish and Game Warden. Hearing my engine popping and certain that it was a boat which contained Americans fishing without a license, he had laid in ambush at the lighthouse station to make a seizure.

He had fairly danced a jig, the old man said, chucklingly, when he found that I was heading in—running right into the jaws of his trap. His disappointment at finding no evidences of fish or fishing was due, the old man explained, to the fact that the penalty for aliens caught poaching is an especially heavy one, and that a very sizeable cut goes to the warden making the arrest.

As the weather looked far from settled, I was glad to accept the warm invitation of the good old couple to remain with them for the night. It was not until I started carrying part of my outfit up to the boat-house that I discovered that the keeper was almost totally blind, so that he felt his way with a stick. With the aid of his wife, the station had been run and maintained according to the best traditions of the service, however, and he had been kept there from year to year in spite of his rapidly failing sight. But he realized that the present summer must be about his last, and was turning over in his mind some plan by which to carry on. He had thought a bit about trapping—in fact, had already had considerable success with mink. Perhaps he could trap some fur-bearing foxes and stock an island with them.

Courageous old souls! Both of them were over sixty, and one of them blind. Yet, as we sat around the fire after supper that night, they told me of their plans and ambitions with all the enthusiasm of a pair

of young immigrants just out from England. But what a spirit the fine old chap had I did not appreciate until I received a letter from him a few months later. Thanking me for a number of photographs of the station and islands I had sent, the pencil-scrawled note (evidently dictated to his wife) continued:

Well, we had a very rough Fall. I could not get over to the Bustard Islands very much, and so set a few traps round near the light-house and caught 4 fine mink.

Well, we were picked up on Dec. 9 to go to mainland for winter. That night it got dark and foggie and raining. Could not see the range lights and so ran the steamer on the Burton Rocks N. W. of Byng Inlet. At 9 we took to the lifeboats and got off all right—a little wet but not suffering. We laid on the floor in the light-house 3 nights with 22 of a crew. My little motor-boat and all our clothing and bedding and all we own was lost. The steamer will remain on the rocks all winter as the wrecking crew cannot get her off.

Well, we go East to my old home for Xmas and expect to have a fine time with lots of cider and good things to eat. Then I will come back and trap. I will write you later about my fur farm.

Yours truly,

Mr. and Mrs. David Mountnay.

And that's the stuff they make lighthouse keepers of in Georgian Bay.

The next day being the Fourth of July, I resolved

to celebrate by attempting to put up a new record for a daily run. About ninety miles was the best I had made so far, but on no day had I run continuously from daylight to dark. Bad weather and rough water had most frequently intervened to drive me to shelter, but with a protected passage inside of the islands now available there was no reason for not keeping going as long as I cared to.

A thick blanket of fog clapped down on the Bustards during the night, but this had thinned enough to give a couple of hundred yards of visibility by the time early breakfast with my lighthouse friends was over and I had pulled out into open water. As it was still too thick to navigate among the islands, I kept outside, steering by compass and the wail of the Byng Inlet Fog whistle. At nine the fog began lifting, revealing the "silver and gray of spit and bay" of the outer island fringe meeting the "steel-backed tide" of the lake.

The fog was gone at ten, leaving behind it the cobalt vault of the first unclouded sky I had seen for many days. With the whistling south-west breeze which had licked up the last of the mist kicking a head sea that threatened a material slowing down of my progress in open water, I took the first occasion to head in to the sheltered passage behind the islands. This was at Port au Baril. Filling up all of my gaso-

line cans at a waterside service station, I pushed off and steered southward into the interminable maze of island channels.

The buoyed channel was easy to follow if one kept an eye closely on the marks. Knowing this channel was for boats of comparatively deep draught, however, I constantly found myself yielding to the temptation to save time by taking one or another of countless passages opening to left and right. The game was a fascinating one and I kept it up for several hours—until, indeed, a few simple calculations revealed that my erratic navigation was costing me about three times the time and distance it was gaining. That kept me to the marked channel for a couple of hours, or until an especially alluring cut-off took me into a nest of shallows among which an aspiring tip of rock poked up to strike the propeller and shear the first pin I had lost on the voyage.

Early in the afternoon I shut off the engine to drift for a few minutes alongside a canoe the heavy load of which indicated it was starting on a long voyage. The sunburned paddlers proved to be Prof. and Mrs. Ingraham of the University of Wisconsin. Without any power save that of their own stout arms, they were just off for several hundred miles of paddling on a route which would carry them through "The Thirty Thousand Islands," French River and the Muskoka

Lakes. It was a glorious prospect, though slightly dimmed at the moment by the aches and pains of first-week sunburn, blisters and paddle muscles.

Camps and cottages appeared to occur in patches. At points there would be one or the other on every island, usually with a hotel and general store making a sort of community center. Then I would run for several miles without seeing any signs of civilization save the occasional marking buoy. Most of the camps were occupied or in process of being opened. Many of the lodges were large and rambling but few were pretentious. The gimcrack palaces which so mar the natural beauty of "The Thousand Islands" in the St. Lawrence have not, heaven be praised, overflowed to Georgian Bay.

All afternoon I waved reluctant regrets to shouted and signaled invitations to land at this camp or that for a yarn or even a more palpable proffer of cheer. But along toward evening the sight of what—judging from the American and Canadian flags in evidence—was an international Fourth of July celebration offered temptation too strong to resist. The rambling log lodge proved to be occupied by a Detroit family, which was giving a house-party for some of its Canadian neighbors. Surmising from what their glasses revealed, that I was a hungry—and possibly a thirsty—American, they sent off one of their guides in a motor-boat to tell me that they were just sitting down

to dinner and that there was an extra place for me.

Fortunately, it was not one of those accidentally "thirteen" parties, where an extra guest had to be found willy-nilly. With two hours of daylight still remaining, stopping for dinner and the night would have put an end to what promised to be the best day's run of the voyage. So, explaining this, I compromised by joining in toasts to the King, the President, Mr. Volstead, the prosperous finish of my voyage, "good fishing," and the healths of the several members of the party. Then, sped by a booming chorus, I pushed off into a gorgeous—a very gorgeous—sunset.

The guides at the lodge had told me of a passage which would save several miles in distance if only I could find the entrance to it. I found the entrance to a passage without difficulty, but it must have been the wrong one. Devious windings ended in rocky shallows from which I had to extricate the boat with oars. That diversion cost half an hour, which might much better have been spent with my jovial friends at the international Fourth of July party.

Hardly had I worked back to the buoyed channel than I was hailed by a pair of wildly paddling canoeists, who begged that I give them a tow so that they could catch the steamer at Sans Souci Landing, a mile ahead. After tangling up their painter in the fly-wheel of my engine and nearly winding in the canoe over the stern, the paddlers suggested that I

take their passenger aboard and make a dash for the already overdue steamer without them. This I was glad to do.

Lifting what proved to be a somewhat hysterically flustered girl over the side, I started the motor and headed up toward where the steamer lights were just beginning to glide across those of the landing. There appeared to be some shouting and gesticulating in the canoe as we left it astern, but my passenger would not hear of shutting off the engine to learn what it signified. She was to be a bridesmaid at a wedding in Hamilton, she said, and this steamer would connect with the last train that would get her there in time. Wouldn't I please, *please*, step on my engine and get her to the boat!

The steamer was backing away from the landing while we were still a couple of hundred yards away, but by running alongside I managed to deliver my passenger into the extended arms of a waiting deck-hand without putting the nose of my boat into a churning side-wheel. Running back to the landing to make inquiries as to a camping place, I encountered the canoe just coming in. One of the paddlers, at imminent risk of an upset, was standing up and waving a plethoric bag from the bow. His sister had forgotten it on leaving the canoe, he explained, and—as it contained both her bridal dress and a mess of trout wrapped up

in ice—she would be particularly annoyed. As I pushed off they were trying to charter a speed-boat in which to overtake the steamer at the next landing. As the bag was already dripping water which smelt of fish, I have often wondered in just what condition that bridesmaid's gown was delivered.

The seventh filling of gasoline was just at an end when I landed for the night on the rocky point of a little island a mile beyond Sans Souci. There was no way of accurately logging the distance covered in my windings, but, at the rate of fifteen miles to the gallon, it would have been something over a hundred for the day. By the direct course down the bay outside of the islands, the distance would have been much less.

Gathering what wood I could lay hands on in the darkness, I made a fire on the rocks in preparation for a hearty camp supper. When I opened my grub-box, however, it transpired that my late passenger was not the only one who had been guilty of forgetfulness. Having neglected to replenish provisions at Port au Baril, I found my larder reduced to a can of jam and a small hunk of bacon—hardly what could be called a balanced diet at the best.

I was awakened in the morning by the crowing of a rooster and the cackling of geese. The rest of the island was occupied by a hunting lodge, and the caretaker had evidently made provision against the days

that nothing fell to the guns. I had made my Fourth of July dinner on bacon and jam within forty yards of a chicken-coop!

After getting lost twice the next morning—once having to do fourteen miles of extra distance by running more than half way into the deeply indented Twelve-mile Bay—I decided that inside navigation was too slow except as a last resort in case of bad weather. Pushing westerly, therefore, through the outer fringe of islands, I headed down in deep and fairly open water toward the end of Georgian Bay. Passing east of Giant's Tomb Island with the striking monolithic crown of rock which gives it the name, I ran to the west of Beausoleil Island and opened up the broad, shallow bay which had its head at Port Severn, where I expected to enter the Trent Canal.

The transition from the wilds of "The Thirty Thousand Islands" to the civilization of the head of the bay was almost startling in its suddenness. Several towns, chief of which were Midland and Port McNicoll, broke the encircling shore-line, with roads and rectangles of regular cultivation running back over rounded hills from which the forests had long been cleared. The funnels and masts of steamers were silhouetted against the towering cylinders of grain elevators; horizontal jets of mingling white smoke and black marked the course of trains.

As the direct course to Port Severn appeared from the chart to be thickly beset with shoals, I landed at a little wooded island near the mouth of the bay to learn, if possible, if it would be necessary to follow the circuitous track of buoys by way of Port McNicoll. Scarcely had I moored my boat than the brisk northerly breeze which had been driving me along all afternoon increased to a strength which turned even the partly sheltered waters of the bay white with breaking waves. This gave me time to study a large-scale chart and to have early supper with the friendly old couple who had caretakers of the lodge on the island for many years.

x The water of most of the east side of the bay was so shallow, I learned, that it would be safest to take the long way round by Port McNicoll on the probability that it would be the shortest way out.

Shoving off at six o'clock, I found, as soon as I was clear of the lee of the island, that there was still more wind and sea than I would have preferred for the crossing of six or seven miles of open water. But the menace to my own stanch and well-powered little boat was nothing to the threat to a thin sliver of a canoe which went scudding across my bows just as I began to have recourse to the bailing bucket. With an unreefed sail large enough for a small sloop, the audacious little craft went banging on into the

breaking seas while her active but apparently otherwise unconcerned crew of two sat on the weather gunwale to keep her from being hove flat.

"Those chaps are either plumb crazy, or else they are past masters of canoe sailing and have a lot of nerve on top of it," I said to myself, wiping the spray out of my eyes and turning again to the bailing bucket.

Just how much that pair knew about canoes, as well as something of the amount of nerve they had, I was to have an illuminative example a couple of days later.

Turning eastward where the channel ran in to Port McNicoll, I followed a devious line of buoys through constantly shoaling water, to reach the mouth of the Severn and the beginning of the Trent Canal half an hour before dark. In spite of the lateness of the hour, an obliging lock-master volunteered to put me through into Gloucester Pool so that I could make an early start in the morning. The little old-style lock was extremely rough when the water was turned in, and I had a lively time working with ineffectual oars to keep my tilted motor from banging against the sides. I resolved to use mooring lines like the larger craft in later lockings, but more spacious locks and less violent flows of water made this unnecessary.

The route of what is now called the Trent Canal follows a connected series of lakes and rivers that

formed an early Canadian waterway scarcely less historic than the one I have already described as using the Ottawa, Lake Nipissing and French River. Both routes saved time and distance on the westward voyage, and both avoided the open waters of Ontario, Erie and Huron. Champlain was the first European to use the Trent-Severn route, and it was followed in one direction or the other by voyageurs right down to the time of the railway and steamer.

The first official suggestion for constructing a canal from Lake Ontario to Lake Huron came, interestingly enough, from the Duke of Wellington. Pointing out, in a memorandum written but a few years after his victory at Waterloo, that the control of Lake Ontario would almost certainly be in the hands of the Americans in the event of another war with Canada (as had been the case in 1812-15), the "Iron Duke" recommended the construction of a waterway far enough back from the frontier to be comparatively safe from enemy attack. The tentative route sketched for such a waterway included most of that followed to-day by the Trent Canal.

The first work to be done on the proposed Ontario-Huron Canal was in the form of a lock at Bobcaygeon, begun in 1833 and finished two years later. Locks at Glen Ross, Peterboro, Hastings and Lindsay were started between 1837 and 1840, but were left in an incomplete state for many years. When locks

250 BY WATERWAYS TO GOTHAM

were completed at Young's Point and Rosedale between 1869 and 1872, five unconnected reaches of navigation, totaling 172 miles in length, were available, though only 137 miles formed a portion of the present through route. From 1883 to 1887 locks built at Burleigh, Lovesick, Buckhorn and Fenelon connected longer existing reaches of navigation, but still left it divided into three parts. Work on the Peterboro-Lakefield Division and the Balsom-Simcoe Division from 1905 to 1907 opened a continuous stretch of inland navigation of 167 miles. Between 1907 and 1918 the construction of the Ontario-Rice Lake Division, thirty-six miles in length, gave through water communication from Lake Ontario to Washago. The locks of the Severn Division, from Washago to Georgian Bay, are still incomplete, but that stretch (mostly following the River Severn) is at present available for craft not exceeding fifty-six feet in length by the use of two marine railways.

The plan of completing the Trent Canal as a waterway whose principal *raison d'être* would be its safety from American attack in event of war ceased to have force many decades ago. The construction of the sixties and seventies was calculated to assist lumbering and promote colonization, while that of the next twenty or thirty years was launched on the theory that a through water route from Huron to Ontario could be utilized by the grain and iron carriers. The rapid

increase in the size of the latter, with the incident improvement of the Welland Canal around Niagara to handle them, put an end to the hope of developing this traffic or any other interlake trade of commercial importance.

Present construction on the Trent Canal is confined almost exclusively to hydroelectric development and the improvement of facilities for the passage of pleasure craft. In these respects it is having a success which promises more than to compensate for the failure of the commercial waterway dream. The water power already developed is probably worth more than the total expenditures on the project from the inception of work nearly a century ago, while there still remains much potential power to be harnessed. As a waterway for pleasure craft the 240 miles of connected river and lake of the Trent Canal knows no near rival on the North American continent, nor anywhere else in the world, for that matter.

My own reasons for routing by the practically completed Trent Canal of to-day were very similar to those which turned Champlain and the early voyagers to that traverse two and three centuries ago—the desire to save time and distance, and, especially, the avoidance of the open waters of Lakes Huron, Erie and Ontario. I would, it is true, still have to coast the lower end of Ontario for some distance, but this would be largely inside the islands forming the Bay of

Quinte, with exposure to the winds and seas of the main lake at only two or three points. Of open water I already had had quite my fill for one voyage.

Spending the night of July 5th on the boat-house landing just above the first lock, I tumbled out at daylight to start my first day's run through the Trent Canal. Intending to cook breakfast on my little "canned-heat" stove while under way, I had hardly pushed off when a hail from the bank brought an invitation to have a "real square" with a party of fishermen up for the week-end from Toronto. A fry of bass which had taken the hook but a few minutes previously more than compensated for the loss of time.

The first few miles up Gloucester Pool were a devious series of windings among the stumps of the trees which had died when the water was backed up behind the dam. Then the lake narrowed and buoys led up to where the Severn entered between sheer rocky cliffs. Danger signs here warned of the threat of the swift current and log booms had been placed to fend passing craft from collision with the rough walls. Possibly a motor cruiser of forty or fifty feet might have run some risk of bumping here if carelessly handled; for a small boat the warning was superfluous. In the completed project, this short reach of fast water will be wiped out by a dam and passed by a



THE SPILLWAY AT SWIFT RAPIDS, TRENT CANAL



THE MARINE RAILROAD, TRENT CANAL

lock. It is called Little Chute. Before the waters of Gloucester Pool backed up below it there must have been a real rapid there.

At Big Chute, which is also to be passed by locks now under construction, my boat was taken onto the car of a marine railway and hauled by a cable up a steep incline and deposited in the still water above the dam of the hydroelectric plant.

A marine railway is faster to operate than locks but is also more expensive. Its worst handicap, however, is the restriction of the size of the boats to be handled to conform to the limiting size of the cars. For instance, boats of a length of 117 feet and of 22 feet beam can be taken through the Trent Canal from Lake Ontario to Lake Simcoe. From Simcoe to Georgian Bay the largest craft that can be taken through the canal is limited to a length of 56 feet and a beam of 13.5 feet by the size of the marine railway cars at Swift Rapids and Big Chute. No date has yet been set for the completion of the locks which will permit the navigation of the larger size boats all the way from Ontario to Huron.

✕ While I lingered for a yarn with the engineers of the hydroelectric plant who had come down to the landing another little craft was brought up the marine railway. The fine lines of what turned out to be a 16-foot canoe had a familiar look to me, and presently a huge sprit sail, furled and lashed along one

of the gunwales, identified beyond doubt the bit of a craft which, flying like a witch on a broomstick, had crossed my bows the evening before just outside of Port Severn. And one of that mad crew now turned out to be a woman!

The skipper of the canoe—a tall, bronzed muscular chap, with a mane of gray hair as tousled and unruly as the famous mop of Mark Twain—came over and introduced himself as George Douglas. He had a home and a camp or two scattered along the lakes midway of the canal, and was just returning with his wife from an all-too-hurried canoe jaunt to Georgian Bay. As our respective commands appeared to be of about equal speed, it occurred to him that I might care to make a party of it as far as Lakefield. There were two or three points where the markings were a bit confusing, and it would probably save me some time to have a guide who knew the waters.

Having been unable to obtain any charts of Trent Canal other than the Canadian Geological Survey sheets, I fell in with the plan at once. The occasion appeared to be one of the very rare exceptions to Kipling's rule that

“Down to Gehenna, or up to the Throne,
He travels the fastest who travels alone.”

It was not until later that I learned that Douglas had a distinguished record as a mining engineer and

Arctic explorer, and was also rated as one of the first authorities in Canada on canoes and canoe-construction. So it appeared that there was probably less madness and more method than I had anticipated in the driving of his canoe into the teeth of those Georgian Bay squalls.

Saying that there was every indication of the breaking within twenty-four hours of a storm of several days' duration, Douglas suggested that it would be advisable to start at once and run steadily in an endeavor to reach the farther shore of Lake Simcoe before dark. It would be out of the question crossing that broad expanse of open water in a violent wind, while weather on the smaller lakes beyond was a matter of small import—if one didn't mind a wetting and the occasional pushing ashore of a swamped canoe, that is.

Running in a narrowing lake of quiet water over what must have originally been the bed of the tumbling Severn, we made the nine miles and a half to the foot of the marine railway at Swift Rapids in an hour and a quarter. As Douglas had surmised, our two crafts teamed together very nicely. My heavier boat and outfit weighed enough more than his to bring down the speed of my three-horsepower Elto almost to that of his two-horsepower Johnston. A bit of practice soon proved just how many notches I had to shut down to "keep station" astern of the guiding

canoe. Thereafter, as long as Douglas ran wide-open, I could hold my place for miles without touching my motor. With a head-wind and a rough sea, of course, my extra horsepower was more at a premium, so that I had to shut down still further to keep my place.

The lift of the marine railway at Swift Rapids was forty-seven feet, eleven less than that at Big Chute. Sixteen miles more up the quiet Severn—part of it through Sparrow Lake—brought us to Washago and to Lock 42, the farthest west of those of the completed project. Here a lift of twenty feet carried us to the level of Lake Couchiching, lying just beyond. There, at a total elevation of 140 feet above Georgian Bay, we finished climbing for the day and concentrated our energies on the long unbroken run of twenty-five miles up Couchiching and across Simcoe.

Narrow and friendly Lake Couchiching was gay with the boats of Sunday holiday tourists, but once through the narrow passage to Simcoe unbroken water met our eyes to south and east. The forest along the shore for which we headed was a barely discernible line of blue haze low down on the horizon. The afternoon was clear and quiet, with only a sinister murkiness far to the south indicating the change of weather promised by the barometers.

Douglas shot too close in passing a small island just after we had entered Simcoe, forcing a half hour's

stop for repairs to his propeller. Then we headed right out into the lake and ran for two hours with only the single stop each craft made to refill gasoline. Not a breath of air was stirring. The water had a shimmer of golden silk in the light of the declining sun. I ran for miles without touching the tiller-lines, swaying slightly from side to side now and then to correct the course. That was the last good weather I had on the voyage. I do not recall another day on which there was not more wind than I would have liked—and most of it abeam or dead ahead.

Heading for a pair of outreaching concrete jetties which beckoned welcome from the nearing easterly shore of the lake, Douglas ran under a bridge and entered a long stretch of stone-banked artificial canal. Landing at the first place which offered a chance to secure the boats, we pitched camp upon the grassy bank above.

The trio of us made a very effective division of labor when it came to camp work. Douglas chopped wood and pitched his family tent, I fried potatoes and bacon, while Mrs. Douglas contrived a salad and dessert from various things in cans. That done, she went foraging among the nearby farmhouses, to return just after dark with milk, cream, strawberries and fresh eggs for the morrow's breakfast. Notwithstanding all argument to the contrary, a woman is really very useful around camp in doing the intermin-

able odds and ends of things the average man feels just a bit above doing. No man could have made such camp dainties as did Mrs. Douglas—nor yet cajole such stores of fresh provender out of farmers. I was highly jubilant over the way my newly-formed partnership was working out and promptly began laying plans for perpetuating it all the way to New York.

There was a heavy wind roaring through the tree-tops the next morning but that it was approaching the force of a gale did not become evident until we had been lifted through the Gamebridge Lock and come out upon an opener stretch of canal. It was a lively dance from there on but rarely with enough open water to give the wind sufficient sweep to kick up troublesome seas. Five locks, with a total lift of seventy-four feet, brought us up to the level of Cranberry Lake, near the head of which we stopped for lunch. Here the wind was so violent that it dislodged the Douglas canoe, dragged half way out of the water, cast it adrift and blew it to the opposite side of the narrow arm of the lake. Fortunately the derelict did not upset and I was able to follow in my own boat and retrieve it with little difficulty.

Running through a deep cut in the rock the sides of which were so thickly tapestried with wild strawberries that we filled several cups from our craft, we came to the foot of the great Kirkfield Hydraulic Lift Lock. Here the boats, with the basin of water which floated



OUR CAMP ON STURGEON LAKE



TIED-UP AT THE DOUGLAS BOAT-HOUSE

them, were raised fifty feet at a speed about equal to that of the hydraulic elevators in old-type buildings. The movable parts of the lift are balanced in weight, so that the letting in from above of a column of water slightly higher than that in which the boat to be raised is floating below does the work.

A hydraulic lift lock works with much less water and at much faster speed than a lock of the ordinary type. As the initial cost is much greater, however, as well as the expense of operation, it is resorted to only where limiting topography makes it necessary to have a high lift at one point. With the exception of a single lock of this type in Belgium, the hydraulic lifts at Kirkfield and Peterborough—both on the Trent Canal—are said to be the highest in the world.

We were now at the summit level of the Trent Canal, nearly 600 feet above that of Lake Ontario, the descent to which would be made by thirty-five locks in a distance of 166 miles. Crossing a small lake, six miles of canal carried us to the western shore of Balsam Lake and the first point where we were really exposed to a clean sweep of the wind. Taking it for granted that Douglas would not risk his overloaded canoe in water which was rather rougher than I was happy to face in my much larger and stancher craft, I was heading in for a sheltered landing when a hail from my companions indicated they wanted me to run up alongside them. Both were busy shifting

cargo, but Mrs. Douglas paused long enough to ask me if I would mind running on outside and seeing what the water was like while they finished retrimming their load for the run across. Waiting for the wind to go down seemed never to have entered their heads.

The wild wallow of cross-waves tossed back and forth between the walls of the concrete jetties gave me a rough tousling and several inches of water in the bottom of the boat; outside, where the seas ran a bit more rhythmically, it was better and I found that I could make very fair weather of it by not driving too hard. Quite convinced, however, that the canoe had not one chance in a hundred of living in the cross-waves between the jetties, I shut off my motor and, holding the boat's head up with the oars, started drifting back to the shelter of the inner canal. Glancing shoreward to get a bearing, my astonished eyes fell upon that blessed little canoe tossing in the heart of the welter of foam and up-ended waves and apparently very near to swamping.

Running in under power to pick up the survivors, I found that the canoe, while partly full of water as I had anticipated, was still very much under the control of its ecstatically grinning crew. Shouting through a megaphone improvised from the soup dish and frying-pan with which she was bailing with either hand, Mrs. Douglas informed me that, if I would

stand by in case of trouble, "George would like to try it under a slow engine." And so round I came again, and out we went.

It did not occur to me until afterward to take Mrs. Douglas and a part of the drenched load of the canoe under the spray-hood of my own craft. It would have saved her an hour's soaking, but it would have ruined an hour's fun. Also, I am inclined to think that the canoe would never have avoided swamping in the cross-waves between the jetties without her vigorous two-handed bailing. At any rate, Douglas took the precarious little shallop out just as she was, and won his way over with her. Something worked loose in his engine before we were half way across, but he made the lee of Grand Island and effected emergency repairs without difficulty. With the eastern shore of the lake forming an increasingly effectual barrier to the wind, the remainder of the run to the outlet was comparatively quiet.

Our first drop in the long descent to Lake Ontario was a small one of four feet at Rosedale, not far below the outlet of Balsam Lake. This let us down to the level of Cameron Lake, after traversing which we locked through a double flight at beautiful Fenelon Falls—twenty-three feet in all—and found ourselves at the head of Sturgeon Lake. Running half-way down this narrow, L-shaped body of water, we landed on a grassy point, where much driftwood and a grove

of fragrant, close-growing cedars to break the wind made an ideal camping-site.

The roughness of our passage of the comparatively small Balsam Lake made us realize our good fortune in having put the broad expanse of Simcoe behind us when we did. The next Toronto paper to come to our hands told of the upsetting of several boats on that lake the day after we crossed it, with a number of drownings. The only survivor of one party was a girl of sixteen, found four days later where the capsized boat had drifted ashore at a remote part of the lake.

Pushing on down Sturgeon Lake after an early start on the morning of July 9th, we passed, at Bobcaygeon, the historic lock with which work on the Trent Canal was inaugurated nearly a century ago. This let us down to the level of sprawling Pigeon Lake, out of which we passed without locking to thread the marshy mazes of Buckhorn Lake. At Buckhorn Lock we were dropped eleven feet to Lovesick Lake level, from which a four-foot drop in the lock of the same name took us to the double flight at Burleigh Falls. Here a descent of twenty-four feet left us among the islands at the head of Stony Lake, perhaps the loveliest of all the lovely lakes along the Canal.

At Lovesick a puffing fat lady, who said she was from Rochester, scrambled up to the lock to shake hands with me because I had come "all the way from

the States.” There was nothing to indicate that the soft and sentimental name of the place had gone to the poor dear’s head, but that she was at least *homesick* there was every reason to believe.

Half way down Stony Lake, Douglas ran in alongside a boathouse landing and announced that we were “home for the night.” It was his Wee Island lodge, a perfect little gem of a place, with nothing but the cabin to break the illusion of primeval wildness. That was my first night between sheets since leaving the shores of Wisconsin.

CHAPTER XI

DOWN THE ST. LAWRENCE

After two days at the Douglas home place, Northcote Farm, I pushed off into Clear Lake to continue my voyage to Lake Ontario. There is a heavy descent between the attractive little resort town of Lakefield and Peterborough, most of it made at the big lift-lock just above the latter. Spending the night in this beautiful and prosperous home and industrial city, I lingered an hour the next morning for an all-too-hurried visit to the Peterborough Canoe Works, probably the finest plant of the kind on the continent. I had known the stanch and useful little Peterboroughs on most of the major rivers between the Yukon and Amazon, and it was an interesting thing to see them in process of coming into being.

The persistently strong southerly wind gave me a bumpy passage down Rice Lake, but narrower waterways beyond afforded quieter waters. Passing two more flights of locks before dark, I found further progress barred over the week-end by a rule against Sunday operation. The delay was more than compensated for by the fact that the day was spent in the company of a fine old chap called Sergeant Messen-

ger, the lock-keeper, who turned his office over to me for a sleeping room.

Messenger's was a splendid record. After serving two or three full enlistments in the Indian Army, taking part in campaigns in Burma and on the Afghan frontier, he had come to Canada to settle down. Well into his fifties when the World War broke in 1914, he had managed to get himself accepted as a gunnery instructor, which finally led up to three years of active service with the Canadian artillery in France.

Practically every lock-keeper in both the Trent and the St. Lawrence River canals were ex-service men, and I have no doubt that time and opportunity to get acquainted would have revealed many another record just as fine as that of good old Sergeant Messenger.

Locked out of the last gate on the Trent River a little after noon on my second day of running from Peterborough, a half hour down a broadening river took me under the Trenton railway bridge and to the shores of Lake Ontario. From here I had been assured that the long, land-locked Bay of Quinte would give me protected water nearly all of the way to the mouth of the St. Lawrence. But I now discovered that this straggling, winding inlet, which had looked scarcely more than a broad river on my small-scale chart, had an average width of a number of miles. With the whistling lake wind, this proved quite

enough to set good smashing seas running. There was a double line of surfs breaking against Trenton breakwater, and a fluttering of white-caps as far as the eye could see.

With no prospect of a change of weather or a shift of wind, there was nothing to do but try to bang through to the lee promised by the outer line of islands, and then work easterly as opportunity offered. It was a rough run across, with the bailing bucket busy from the moment the breakwater was doubled. Then there was quieter going until the bay began to broaden out a few miles beyond the railway bridge which crosses the shallows opposite Belleville. I should hardly have ventured on this wind-swept expanse of open water at all had not a very pretty eighty-foot schooner, running only under power, put out at the psychological moment on the identical course I would have to follow to make the lee of the next island. Running my spray-hood back a few feet more, I tanked up again and headed off on a parallel course.

That would have been a wet passage even at reduced speed; running wide-open to keep station with my adopted consort it was cataclysmic. Water gained on me steadily in spite of all I could do with the bailing bucket, a circumstance, however, which was robbed of most of its menace by the fact that there was little doubt that the boat would be taken in tow even if it did swamp. Just the same, I was heartily

glad to nose into the quieter waters in the lee of the island and run on to a safe mooring behind the dock of a pretty little hillside village just recovering from the effects of a fire which had all but wiped out its business section.

Running in a beautiful land-locked series of passages the next morning, the wind did not become an element to be reckoned with again until nearly noon. By that time I had passed the most easterly point of the sprawling peninsula, behind the shelter of which I had been running all the way from Trenton, and was heading across the wide passage to the west of Amherst Island. Broadside on to the seas rolling in from the storm-swept lake, I was soon taking water aboard at a rate which made highly welcome the appearance of the dock of a fishing-boat harbor on the northern or mainland side of the long bay. Here, in a quaint old village founded a couple of centuries previously by a colony of religious refugees somewhat akin to the Puritans, I stood-by until a temporary lull in the wind an hour before daybreak made small-boat navigation practicable again.

I made good progress until the lake-wind came up with the sun, and then had a touch-and-go run of the open passage between Amherst and Wolfe Islands. Reluctant to give up with the spires and stacks of Kingston already in sight, I kept plugging along until the rolling beam seas lost their sting as they were

brought quartering and finally astern. By mid-forenoon I was snugly berthed at the dock of one of the St. Lawrence River steamship companies.

The site upon which the beautiful little city of Kingston is built originally gained importance from its command of the entrance to the St. Lawrence. Frontenac built a fort there in 1673, and shortly afterward this was turned over to La Salle, with the privilege of founding a colony and establishing a settlement of domesticated Indians. La Salle was growing rich from fur-trading profits when the lure of exploration drew him West and he departed upon the expedition which discovered the upper Mississippi but ultimately resulted in his death. The fort was destroyed and abandoned to the Iroquois toward the close of the seventeenth century, the sequel to an unprovoked massacre of those Indians instigated and carried out by the French. Restored and regarrisoned a few years later, it was captured and destroyed by the English in 1758, during the French and Indian War. The keystone of Canadian defense against the American colonies and the young republic which followed, Kingston has lost its military importance as relations between the States and Canada have improved to a point that all but wipes out the political boundary. It is best known to-day as the home of a Canadian military academy similar to the American West Point.

A French-Canadian pilot of one of the steamers

running the river to Montreal, learning that I desired to make the voyage as expeditiously as possible, gave me a set of large-scale charts and spent an hour laying out the shortest course. He thought it would be quite safe to run all of the rapids down as far as the "Long Soo," but advised strongly against attempting that or anything below, including Lachine, at Montreal.

Running out of Kingston Harbor immediately after lunch, I was into the Thousand Islands within a few miles. As in the case of the Thirty Thousand Islands of Georgian Bay, nomenclature here has been conservative. By actual count, there are 1692 more or less extensive bits of rock breaking through the surface of the St. Lawrence between the foot of Lake Ontario and Prescott, fifty miles below. Certainly no Yankee land promoter had anything to do with bestowing the name. Off the Florida coast that number of islands would never be rated at less than a million, "and every one of the milyun blessed with the full infloence of the God-given Gulf Stream, sah!"

It is customary to apply the name St. Lawrence only to the seven hundred miles between Lake Ontario and the Atlantic. Strictly speaking, however, the head of that river system would be found at the fount of the remotest tributary of Lake Superior, over two thousand miles from the sea. There are many longer rivers than this, but probably only the Amazon dis-

charges a greater amount of water. Despite its great flow, however, there is no other great river with so inconsiderable a seasonal fluctuation. This is due entirely, of course, to the fact that floods are stored and the flow equalized in the reservoir of the Great Lakes. There, also, all silt is settled. The waters of the St. Lawrence are as notable for their crystalline clearness as are those of the Missouri and the Colorado for their muddiness.

Running close to Whiskey Island, generally rated as the first of the Thousand, I crossed a broad patch of well-charted shallows and cut several miles off the somewhat circuitous steamer channel. Jazz bands were rending the pure river ozone to left and right as I turned in toward the pretty resort town of Clayton, but I thriftily ran the gantlet for the sake of saving fifteen cents a gallon on American over Canadian gasoline. And the strains of jazz assailed me from port and starboard as I sped through the lengthening end of the afternoon shadows past the thronged resorts of Thousand Island and St. Lawrence Parks. Salvos of jazz exploded in the purple twilight as I scudded by Alexandria Bay, and jiggers of jazz stabbed down at me through the darkness from an excursion steamer as I took my course from the winking light buoys and drove on between the Summerlands and the Excelsiors. And when I had made precarious camp for the night on a bare rock called Pov-

erty Island Shoal, a speed-boat from Goose Bay laid up alongside a neighboring pinnacle and a lovesick youth poured out his soul to the stars by playing "*Oh, Boy, What a Girl!*" on a catarrhal saxophone.

The Thousand Islands must have been a really delightful retreat in those halcyon days when there was nothing worse to disturb the visitor than the gentle Iroquois and his scalping-knife.

Passing Grenadier Island the next morning, my course was down a broad expanse of almost currentless river many miles in breadth. The hitherto widely separated American and Canadian channels had now united, with the international boundary line running almost along the middle of the river. Many Indian legends cluster about this section of the islands, which is also credited with being the locale of the culminating scenes of Cooper's "*Pathfinder.*" Brockville, famous for its Indian picture-rocks, was sacked during the War of 1812 by an American expedition which crossed the river on the ice. The picturesque town is near the foot of the Thousand Islands. Running by the Three Sisters group just below, I became aware for the first time of a slow but steady downward set of current. It was good to feel moving water under the keel again.

Ogdensburg, with its many factories blackening the southern skies, offered the last opportunity to tank up on cheap Yankee gasoline before the river swung

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north into Canada away from the boundary line, but the fact that I was on the Prescott side of the river, with the first lock of the St. Lawrence canal system close at hand, made the run across several miles of wind-blown waters more trouble than the carrying out of the patriotic impulse to foster home trade was worth.

An artificial channel dredged between Spencer and Drummond Islands led down to the head of the Galop Rapids and the entrance to the canal of the same name. It looked like an easy, comfortable run down through the long, undulant waves, but because it is required that one apply for a permit at the upper locks it was necessary to make the passage by at least a part of the canal. And so it was that, taking the longest way round which is also supposed to be the shortest and safest way out, I lost a couple of hours of time and came uncomfortably near to losing my boat and outfit.

Nothing is more of a nuisance to lock-masters putting through a heavy run of steamer traffic than small pleasure craft. Notwithstanding this fact the men in charge of the busy St. Lawrence River locks were no less courteous to me with my little toy outfit than had been those of the Trent Canal with their average of only a boat or two a day. It was only reasonable, however, that the lock authorities should expect pleasure craft to save the time of all concerned by going

through the regular traffic. So when one of the hands at this first (or rather the last, for it was Number 28) of the locks of the St. Lawrence system signaled for me to run in and lock down with a big Great Lakes freighter, I was entirely willing to fall in with a plan which would save my waiting while the big basin was emptied and refilled.

The lively diversion that followed was probably due to two things—my failure to demand mooring lines and the neglect of the lock men to tell the captain of the freighter that there was a very small open boat drifting at large in the scant thirty feet of space between his stern and the lock gates. Settling down gently and quietly enough until the gates ahead were opened on reaching the lower level, there was no trouble until the impatient skipper had rung up a sufficient rate of revolutions on his engines to turn the back of the lock into a veritable maelstrom. Unable to use more than one oar at a time, I was bumped impartially against the concrete sides and the steel gates, before being caught in a forward suck intent upon drawing my boat in between the slowly accelerating freighter and the lefthand wall.

Fending off from the wall with a prodded oar, I drove the boat under the projecting stern of the freighter and, inevitably, onto the boil of water above its spinning screw. Fortunately, the tendency of this aspiring geyser was to exert an outward fling rather

than an inward draw. So the only consequence of my running into it was for the boat to roll half over and then go reeling back broadside against the gates. Here the forward suck began to work again, but before the next round of the vicious circle was under way I caught a line flung down from above and the funny little impromptu monkey-show was over. The captain of the freighter probably never knew what had been going on. Indeed, the first word that even the lock-master had of it was when I went up to his office for my permit.

A man navigating a small craft among large ones in restricted spaces, and especially those in which such violent currents are set running as in locks, cannot possibly be too careful. Locks, under these conditions, are far more dangerous to small boats than are rapids. I would vastly prefer an upset in any rapid I saw on the St. Lawrence to playing again that altogether disconcerting game of pitch-and-toss with the propeller and the gates of the lock. A little more care on the part of the lock-hands, the captain of the freighter or myself would almost certainly have prevented the trouble. And yet, with both eyes open and doing the very best I could, I ran right into a no less serious traffic mix-up with a steamer the following day.

The Galops Canal continued several miles farther down the river to another pair of locks at Iroquois, but this lower section was only for the use of up-

stream traffic. I found only a three- or four-mile current on running out into the river at the foot of the upper locks, but the viciously side-swiping wind sweeping around Lotus and Lalone Islands made for very sloppy going. Chilled with blown spray, I was glad to tie up opposite Iroquois and camp for the night on the grassy bank above Lock 25.

Without abating a whit of its force, the wind shifted during the night and by morning was chilling the blue-green St. Lawrence with the frozen breath of the plains of Labrador. Rolling out of frost-stiff blankets at daybreak, I shared a pot of coffee with the friendly night-shift men of the locks before pushing off onto a river torn with white-caps and streaked with blown spray. Rapide Plat proved easy running, and by taking the course down the narrow channel past Ogden Island I avoided the delays of passing through the winding Morrisburg Canal and Locks 24 and 23. When the rapid paralleled by the Farran Point Canal showed water unbroken save by the force of the wind I decided to run on past the entrance of the Cornwall Canal on the chance that its many locks and nine or ten miles of quiet water might be avoided by running the Long Sault.

Of all famous Canadian rapids, the "Longue Soo" has undoubtedly been the one most celebrated in song and story. This was not because there were not many worse rapids on other rivers, but rather because,

doubtless, a tradition for deadliness had been built up in the popular mind about this spectacular chute and it was convenient to hand when "sure fire stuff" was needed, like flung custard pie or the wronged sister in the movies.

I really knew better, of course, than to plan to run any large rapid without looking it over first from the bank. The reason that I was willing to confine myself to a mid-stream survey of the Long Sault was largely because my table of locks showed that there was only a descent here of about forty-four feet in ten miles. Having run rapids on the Columbia and in the Grand Canyon with as much drop as that in a few hundred yards, I felt that there could not be any great risk here. That a very considerable part of the "Longue Soo's" fall occurs in one continuous pitch near the head there was some indication from the soundings on the chart; yet the full significance of the deep blue colorings and shallow soundings did not come home to me until I had shut off my engine and drifted uncomfortably close to the brink of the really heavy descent.

I am still inclined to think that the main thing operating to upset my calculations was that forty-mile gale from the north-east which, blowing against the current, was exerting its purposeful energies in an attempt to make what would normally have been long, rounded waves rear up and keel over on their backs.



HEAD OF THE "LONG SOO" RAPIDS



BOAT AFTER FORCED LANDING ON ISLAND OF ST.
LAWRENCE

The effect of this was to turn the whole channel into an expanse of blinding wind-whipped white—absolutely “unreadable” water so far as picking a course through it went.

The instant this rather disturbing fact came home to me I realized no time was to be lost in backing up. Starting my motor and throwing it wide open at once, I headed the boat on a quartering course toward the slower water against the bank below the canal. Reassured by the speed through the current, I was just rising to a balanced crouch to take a last look at the tumbling water before I left it behind for good, when, lo!—I was not leaving it. That the first of the breaking waves was perceptibly nearer than when I started the motor was confirmed when a scared glance shoreward revealed the illusion of the canal-bank slowly but steadily sliding back up-stream. Not until I had swung the bow of the boat directly up the channel, so that the motor could exert its full kick against the current, was that downward drift checked. For a minute or two progress, as marked by a sight across to the trees on the bank, was almost glacial in its slowness. Then, as we drew away from the speeding current running down to the brink, progress picked up faster and faster, until finally I was able to lay a quartering course for the head of the canal without losing ground.

From my own standpoint, the performance was not

one to be proud of from any angle. If any credit was to be bestowed, it belonged to the motor for the fine burst of power it had shown in pulling out of the hole my carelessness and lack of judgment had got it into.

Letting down through the first lock of the Cornwall Canal, I ran along a mile or more to a point about opposite to the lower end of the first and main rapid of the Long Sault. From the bank by the side of the river there was as good a view of the famous "Soo" as could be obtained from any single vantage. Even then, however, I was quite unable to determine just what part of the broken water was due to the fall of the river and what to the violence of the wind. From where I stood there were visible several waves at which, if not avoided by even a heavier boat than my own, there would have been trouble. Farther over there appeared to be better water, but even this might have taken on a more threatening aspect as one drew near. It is impossible to get much of a working idea of rough water from a distance.

Natives always have many weird and wonderful recitals about adventures in their rapids, but it is always up to the credulity of the more or less unsophisticated stranger as to how much he shall believe. Taken merely as figments of primitive fancy, based on a framework of fact, these yarns are usually rather diverting; and when one of them is passed on to the

outer world as the higher truth by an avowed seeker for and dispenser of truth, it is more diverting still. The following slightly condensed but otherwise verbatim account of the running of the first steamer through the Long Sault appeared in a handbook issued some years ago under the title of "The Picturesque St. Lawrence."

"The first large boat to attempt the passage of the Long Sault was the *Ontario* built about the year 1840 at the upper end of the lake of the same name. Her speediness attracted the attention of some Montreal men who bought her for a mail boat to ply between that city and Quebec. Then they grappled with the problem of getting her down to Montreal. No craft of anywhere near that size had ever attempted to run the Long Sault; but they secured for the hazardous undertaking two Indians known as "Old Jock" and "Old Pete," the best pilots on the river. The owners promised them one thousand dollars each if they accomplished the enterprise successfully.

"To test the depth of the water a crib was made forty feet square with cross pieces ten feet apart, and having stakes ten feet long projecting at frequent intervals from the bottom. Several Indians towed the crib out into the stream at the head of the rapids and let it go. Meanwhile a number of other Indians had been stationed in trees along the riverside to watch the crib's progress, and still others were stationed at the foot of the rapids where they caught the crib when it reached quiet water. The crib was turned over and it was found that none of the stakes were broken. So it was plain

that there was water enough to run the *Ontario* through.

"The Indians who had been in the trees on the bank then went on board the vessel and the voyage began. Each piloted it in turn as far as he had observed the crib's course. . . . Thus was made in 1843 the first steamer trip down the rapids, and a descendant of one of those pioneer pilots now guides with trusty hand a modern boat that goes over the same course. . . ."

It is just possible that the crib contrivance was tried, though it could have been of no use save in showing the set of the current. Moreover, such a contraption, because not under control, might have been smashed a dozen times in floating down a river where there was plenty of water for a well-handled steamer. The pearl of the oyster, however, lies in the picture of that co-operative association of Indian pilots lined up to take their places at the wheel. To any old river pilot that would be worthy of a place with "*La Chasse Galerie*"—the legend of the aërially navigating bateau.

The passing of several large up-bound steamers in the narrow Cornwall Canal furnished a new experience. Running even at quarter-speed the slowest of these pushed ahead of it a great rounded hump of water several feet higher than the mean level of the waterway, while immediately following was a depression equally pronounced. Running over the brink of the wave between the two with the swift equalizing

current was almost like dropping into the head of a rapid. A steamer which passed while I was moored alongside the bank left my boat high and dry on its side for the minute or two that it took to replace the hump of water pushed on ahead.

Congratulating myself on having avoided a possible swamping in the Long Sault, I pushed on down the Canal to the second lock from the head—Number 20. Seeing the way my boat was bumping against the wall of the wind-torn entrance basin, the lock-master, who at first had asked me to wait until an approaching steamer had been locked up, decided to put me through at once.

There was nothing but the most courteous and kindly intention behind the considerate act. Where the slip came was in not holding back the steamer long enough for me to get well out of the way, and even that would not have made trouble had there not been a confusion of signals. Probably not realizing that there was even a small boat in the lock, the captain of the steamer headed right on into the narrow entrance channel instead of mooring below as he would have to have done had there been a ship of his own size coming down.

When I pulled out through the opening lower gates I found the hull of the nearing freighter filling the passage almost from wall to wall, with room for me to pass only if it was crowded well to one side.

The Mate, directing the handling of the mooring lines from the bow of the steamer, motioned for me to keep to the left. Seeing that the bow was swinging in that direction, however, I assumed that I had misunderstood his signal, and so, throwing my whole weight onto the oars in an endeavor to drive the boat through the narrow lane of clear water, I headed to the right.

The significance of the shouts of warning and the excited gesticulations on both steamer and lock-side came home to me too late to make it possible to change my course. The steamer bumped sharply against the left wall just as had been intended, and then began swinging slowly across against the opposite side. This, working out quite as planned, left me the open passage on the left. Unfortunately, however, as a consequence of my failure to understand the maneuver, I was already well down inside the rapidly closing gap between the port side of the steamer and the righthand wall.

Sensing instantly that twice the speed I could make with oars would not carry the boat clear before the jaws of the closing vise clamped together, I slammed my tilted Elto back into the water and spun the flywheel with almost the same motion. The thing was really too easy after all, I told myself. But when a half dozen savage turns of the wheels had failed to bring even an answering sputter, it began to look as though that optimistic verdict would have to be re-

vised—that, in newspaper parlance, we were about to go to press. At this juncture, fortunately, it broke in upon my befuddled brain that the engine might act better with a little gasoline. An eager burst of power was the response to the next turn, and ten seconds later the boat drove out into the open canal, missing the bump of the port quarter of the steamer against the concrete wall by a comfortable three feet.

From the way the skipper of the freighter was shaking his fist as he leaned out and looked back from the bridge, I was inclined to think he was swearing—and very volubly. Neither would the skipper have been far wrong had he interpreted my own fluent gestures in the same way. Yet neither of us, nor yet the thoroughly well-intentioned lock-master, was greatly to blame. Like the incident of the previous evening in the lock above, it was just one of the things that is likely to happen at any time to the small craft that tries to rush its progress among big ones, especially in and about locks. Even at the expense of disclosing my own rattle-headedness, it will have been worth while setting down what happened in some detail if only it will have the effect of making the next man think twice and take his time in working through locks where large ships and barges are being handled.

Running with a howling gale at my back, I dropped down two locks, passed through the attractive town of

Cornwall, and finally descended by a double flight to the quiet river below the last of the Long Sault. Navigation was comfortable enough until a broadening of the river to the proportions of a lake gave wind and waves a full sweep across the buoyed steamer channel, which was some miles from the northern shore. For a while I kept company with a slow down-bound freighter, the crew of which appeared to be deriving infinite amusement from my efforts to steer and at the same time bail out water faster than it came in. Finally, wet, chilled and weary, I gave up the fight and ran over the lee of a marshy island to make camp for the night.

Not anxious to chance any more rapids while the wind continued, I was quite willing the next morning to take advantage of the locks and canals which avoid the rough water at Coteau, Split Rock, Cedar and the Cascades. Only the last, so far as I have been able to gather since, demand especially careful running. A cross-country hike which I made from the canal in the hope of getting a look at them came to an end in a very dirty little French-Canadian village, with the Cascades no more than a blur of white and green in the distance.

Dropping down through the last flight of locks to the wide expanse of Lake St. Louis, I was hailed from the bank by an officious French-Canadian with what was rather nearer a demand than a request for

a passage across to Lachine. The road was a very roundabout one, he said, and there was no car available anyhow. As he was an engineer on the Government dredge, he knew Lake St. Louis like the palm of his hand. If I would take him along as passenger he would be only too glad to act as pilot and keep me from getting out of the channel. All this in a voluble stream which appeared to assay about ninety-nine per cent French-Canadian *patois* and one per cent English.

Hardly had we started than it became evident that the pilotage I was to receive was to take the form of keeping my tiny craft, with its ten or twelve inches of draught, to the buoyed steamer channel dredged to accommodate ocean-going craft drawing something like twenty feet. With the chart showing more water than I needed right down the direct course to where the distant domes of Lachine were sparkling in the light of the declining sun, I hardly felt it worth while to follow the long, circuitous course of the steamers.

My passenger's preference for the main channel was doubtless due to the fact that the shorter, steeper waves of the shallows were more splashy, and so calculated to do more damage to a newly waxed mustache and a comparatively recently laundered shirt and collar and a perfume saturated muffler of gaudy hue. Possibly I would have been inclined to make the passage as dry a one as was compatible with reasonable

directness had not the self-appointed pilot, arrogating to himself the prerogatives of a real one, grabbed the tiller-lines from my hands and started to put the boat outside of a buoy inside of which I was about to cut.

Not being a good enough Christian to turn the other cheek in the case of so flagrant a case of mutiny on the high seas, I firmly and not too gently recovered the tiller-ropes and headed the boat straight for Lachine. Spray began coming over in showers, and, when I took especial pains to contrive it, a solid green water. At the mutineer's first protest I handed him the bailing bucket, and it took good lively work with that awkward collapsible canvas bag to keep the water below his patent-leather shoe-tops. Had I been alone, indeed, I would have been glad enough to slow down when we ran into the cross-tumble of waves where the brown-black flood of the Ottawa came pouring into the blue-green current of the St. Lawrence. But discipline was discipline, and the constantly improving bailing technique of my very humble and willing deck-hand made it practicable to slash right on through to the finish.

The dripping, drowned-rat figure which oozed up out of my boat onto the Lachine dock appeared to be muttering to itself in staccato *patois*. Among the several words directed toward me as it made off there was not one which under even the most liberal inter-

pretation could have been construed as sounding like "*merci, m'sieu.*"

Lachine is an up-river suburb of Montreal. It was founded by La Salle, but did not receive its present name until that restless young explorer came back from a trip down the Ohio which—from accounts given him by the Indians—he had hoped would lead him to the western ocean and so to the Orient. And when he returned to Montreal after having reached only the falls at the present site of Louisville instead of the Pacific and the China of his dreams, the scoffers, in derision, gave to his post the name of La Chine. The little town was the scene of an Iroquois massacre in 1689, when over two hundred French were killed and half that number carried off as captives.

A quickening current in the narrowing river as I approached the entrance to Lachine Canal brought renewed temptation to try to find my way down by the natural channel. The fact that the forty-five feet of drop was distributed over a considerable distance indicated that there could not be bad water for more than a short stretch, if at all. Remembering my lesson at the Long Sault, however, I finally decided against the diversion on the ground that the lateness of the hour would make it impossible to scout out a channel.

Subsequently I found that there was a compara-

tively easy course down the south side of the river. A fortnight later, on my way to western Canada from New York, Douglas Hains of the Canadian Pacific Railway, with a friend by the name of Lecoffey as bow paddler, took me down this side of Lachine as a passenger. The run was an impromptu one, arranged over the phone on a few minutes' notice. Thanks to skillful handling, most of the wetting we received came from water leaking in through the bottom of the old canoe we had borrowed for the occasion from the guide, Fred Beauvais, who lived near the head of the rapid. My own boat, half as well piloted, should have made a dry run of it.

That the main channel of Lachine is a risky place to take an open canoe was demonstrated a few months later, when Mr. Hains, trying to run through with Beauvais, was upset and very nearly drowned.

On starting up below the upper lock of the Lachine Canal, a reluctant response from the engine was quickly diagnosed as due to a weakened battery. A few moments computation revealed that the scarred and battered Eveready Columbia Hot-Shot which I replaced with a new one here had been in use during all of the 1400 miles or more I had covered since starting. How much is expected from one of these serviceable little boxes I have never learned, but this performance—especially as it was made in almost continuous running, with no chance for the battery to



SHOOTING LACHINE RAPIDS

“rest” and “recuperate”—struck me as rather remarkable. Trying the same battery on the Hudson a week later quite out of curiosity, I had the further surprise of finding that it had picked up enough strength during its lay-off to run the motor for several hours without a miss.

As the Lachine Canal runs through the industrial section of Montreal, there is an almost interminable succession of draw-bridges to be opened for a craft much larger in size than a row-boat. Able, fortunately, to run under most of these structures, I made rapid progress down the busy waterway. Steamers, hulks and barges were waiting at every lock, but these being in pairs, greatly facilitated the movement of the very heavy traffic. Busy as they were, the lock-hands proved no less courteous and considerate than their mates of the upper river in shoving me ahead as opportunity offered.

Since running all the way through the canal would have brought me out among the docks of the transatlantic liners and some distance from the middle of town, I sought moorings at the end of a long basin running up toward the heart of the city almost on a line with the Canadian Pacific Railway station and headquarters. Lined on both sides with coal barges, it was some time before I found a place to tie up. Indeed, I should have found no practicable berth at all had not the skipper of an American motor-cruiser in-

vited me to moor alongside his fine little craft. This proved to be the *Marianne*, of Norfolk. Her beautiful mahogany hull was built by Purdy, and a son of the builder was in command of her. With the owner temporarily away on tour, I was only too glad to accept Captain Purdy's invitation to shake down on board for the day or two of my stay.

CHAPTER XII

TO THE HUDSON BY THE OLD "GRAND PASS"

The Indian village which Cartier found at the base of Mount Royal owed its importance to the fact that it was situated at the main cross-roads of north-eastern water-travel. The St. Lawrence ran east and west, the Ottawa north, while the Richelieu, forty miles below, led south to Lake Champlain. Similar factors have operated to make Montreal the metropolis of Canada and one of the important cities of the Western Hemisphere. With water-borne traffic plying east to Europe and west to the Great Lakes, it is also the main radial center of the principal American and Canadian railway lines of the northeast. With its British solidity and French temperamentality, I know of no city on the continent that holds more of charm and interest for an American. It was with real regret that my limited schedule forced me on my way without seeing more of Montreal than its colorful streets and the incomparable panorama of spreading forests and sprawling river-channels from the summit of Mount Royal.

Resuming my voyage on the second day after my arrival in Montreal, I ran on through the Lachine Canal to be locked back into the St. Lawrence at a

basin flanked by towering grain elevators and the docks of the ocean liners. For a mile or two the swift run of water from the tail of Lachine Rapids made fast going; then the river expanded broadly to left and right and I was soon far from either shore as I ran on down the buoyed channel of the overseas steamers. On the chart this wide reach of open water was marked Lake St. Peter, from which I recognized it as the famous *Lac St. Pierre* of song and story, upon which, among other epic happenings, the *Julie Plante* had come to grief. One of Drummond's priceless *habitants* tells the story.

“On wan dark night on Lac St. Pierre,
 De win' she blow, blow, blow,
 An' de crew of de wood scow *Julie Plante*
 Got scar't an' run below—
 For de win' she blow lak hurricane;
 Bimeby she blow some more,
 An' de scow bus' up on Lac St. Pierre
 Wan arpent from de shore.”

With the wind blowing from “nor'-eas'-wes',” as well as from “de sout,” the captain, crew and the cook, whose

“. . . name was Rosie,
 She come from Montreal,
 Was chambre maid on lumber barge,
 On de Grande Lachine Canal,”

were "corpses on de shore" before the break of another day.

From all of which was drawn the following incontestably valid moral:

"Now all good wood-scow sailor man
Tak' warning by dat storm
An' go an' marry some nice French girl
An' leev on wan beeg farm.
De win' can blow lak hurricane
An' s'pose she blow some more,
You can't get drown on Lac St. Pierre
So long you stay on shore."

From the total absence of wood scows on Lake St. Peter, coupled with the hundreds of picturesque little farms planted thickly along the southern shore, I was strongly inclined to the belief that this conservative advice had been followed to the letter.

Running until the river grew dark with purple shadows, I landed at twilight on the gently sloping beach below the farm of the keeper of the nearby light. The whole family, including mother and daughters, came swarming down to drag my boat back above the devastating wash of passing steamers. Then the kindly folk set out a bread-and-milk supper, entertained me until midnight with stories of their voyaging fathers and grandfathers, and finally turned out at daylight to put the boat back in the river again and speed me on my way.

Your *habitant*, while inclined to be shy and even suspicious of strangers, becomes a very confiding and likable soul on closer acquaintance. The British Canadians who know him best have a great affection for him. Transient visitors rarely take to the *habitant*, however, for in his very dirty towns and villages his worst goods are in his shop windows. Indifference to filth and a dislike of modern sanitation are, of course, legacies from his overseas ancestors.

At beautiful and somnolent old Sorel I came to the town which guarded the St. Lawrence end of the historic Richelieu-Lake Champlain route during the troublous years of fighting of the eighteenth century. As the main waterway between the warring French and British colonies, the "Grand Pass" was fought for from end to end during the French and Indian War and the Revolution, just as the Indians of the north and south had fought to control it for many centuries previously. The bitterest struggles were for the strategic points at the head of Lake Champlain—but every school-boy knows the story of how Ethan Allen and his "Green Mountain Boys" took Ticonderoga and of the capture of Burgoyne and his invading army after he had fought his way down along the "Grand Pass" to the headwaters of the Hudson on a march that was to cut off New England from the rest of the revolting colonies.

Running past the long line of rotting old stern-

wheelers moored just inside the mouth of the Richelieu, I began to ascend a tranquilly flowing stream which sparkled in the sunshine as it wound off to the south between wooded hills and the nestling farms of the *habitants*. Sunshine and tranquillity—doubly grateful after the Labradorean gale which had buffeted me all the way down the St. Lawrence—lasted about three hours, or just long enough for an infernally black dome of clouds to roll up from the south and begin a systematic and methodical attempt to sluice the valley of the Richelieu into the St. Lawrence.

Rounding a sharp bend, I opened up a long reach of river with the forefront of the storm charging down toward me full tilt. Wind-torn nimbus and driving sheets of rain I had expected to see, but the thing that set the hair of my head fairly standing on end was the evanescent vision of what appeared to be a lightning-dazzled wall of water in the act of being lifted bodily and flung forward by the titanic might of nothing less than a full-grown cyclone.

Four years previously I had been tossed on the bosom of a baby cyclone encountered on the lower Yellowstone, but even that incipient twister—though it had blown barns and trees flat before my eyes—had not had the power to stand the river up on end and push it ahead like an advancing barrage. Ready enough to purchase immunity from drowning by fol-

lowing the *habitant's* admonition and "staying on de shore" (if not of going to the length of marrying "some nice French girl and leeving on wan beeg farm"), I turned and headed for the bank.

Shutting off the motor as the propeller churned soft mud, I jumped overboard with the painter and carried it to the nearest tree. On my way back for the stern-line I stole a glance over my shoulder to note the progress of the oncoming Juggernaut of the storm. Driven by spinning gusts of tunneling air, the first big drops of rain were just rat-a-tat-ing onto the canvas spray-hood, but the onrushing wall of up-ended river appeared to have lagged behind. There was still time to study the unaccountable phenomenon through my glasses. Yet the first squint through the revealing binoculars confirmed something of my first snap-shot judgment. It was a wall of tumbling water, surely enough, but hardly an advancing one. It's funny what an excited imagination will conjure out of the sheet of water falling over a dam, especially when half obscured by the curtain of an approaching storm. Navigating with only a small-scale sheet of the Canadian Geological Survey, I had failed to note that I had been nearing St. Ours and the works of the lower locks of the Richelieu.

Banging on through squalls which were really only the skirmishing vanguard of the main storm, I ran along to the foot of the locks. As crude as pictur-

esque, these must have been among the first works of their kind on the continent. As in all old-type locks, the in-flow of water was very torrential, making the careful mooring of a small boat desirable to minimize bumpings and the risk of a possible upset. The lock hands were highly friendly, as were also a bevy of priests who, with many tiltings of mugs, were holding high revel in the shelter of a gnarled old elm on the island cut off from the river by the canal.

Scarcely was I out into the narrow lake above the dam than the storm, having cleared the way with its skirmishing squalls, settled down to a sustained onslaught. Seldom have I seen fiercer rain short of a real cloudburst. Blown almost horizontally, it struck the spray-hood and poured over into the boat in solid streams. Steering became more luck than anything else, for the least corner of an eye cocked under the edge of my sou'wester was instantly blinded with flying spray. Resolving in pure bravado to stick it out as long as my motor would, I let myself in for a full day's run. For the brave little kicker was popping away just as merrily when I stopped for want of light at the foot of Lake Chambly as it had been in the warm sunlight of the morning.

As a consequence of passing through it in so violent a storm, my surviving mental picture of what is said to be some of the finest river scenery in eastern Canada is of little more than a dim gray tunnel streaked

with flying water. Now and then I was aware of the water-fronts of villages, with ferry landings as their most salient features. Frequently dim figures waved ghostly arms at me through the mist. Once, where most of the river appeared to be diverted to a narrow chute between two of the piers of a railway bridge, I fought the swift current inch by inch, with a garrulous French watchman leaning out from an abutment and cheering with all his lungs.

Sleeping comfortably enough under the shelter of an extended spray-hood, I shoved off early in the morning and ran across the lake to where old Fort Chambly, built in 1664, marked the foot of the portage up the rapids of the Richelieu to Lake Champlain. The crumbling towers still reared defiantly against the sky-line as I drew near, and below them the rapids flashed white for a few moments in an unexpected but suddenly quenched burst of sunlight.

Shaded by overhanging trees of great age, the Chambly locks proved even more picturesquely beautiful than those through which I had passed below. Here I found the superintendent of the canal awaiting me with copies of the Montreal papers containing pictures of my departure. He had already 'phoned on to the bridge-tenders along the canal ahead to be standing by to facilitate my passage with quick action at their respective stations.

The quaint old town, straggling for a mile along



THE CHAMPLAIN MEMORIAL LIGHT-
HOUSE NEAR HEAD OF LAKE



OLD FORT CHAMBLY BUILT BY THE
FRENCH IN 1747

the lake, proved quite as attractive at close range as from the water. One of the most interesting sights of a hurried hike to the fort and back was a real old-time blacksmith shop servicing nothing but horses and buggies and agricultural implements. The honest smith and his waiting clientele appeared greatly at a loss to account for the fact that I stopped to photograph them.

That my progress up the next ten miles of the winding canal partook something of the nature of a Roman Triumph was probably due to the fulsome outburst of the reporter of one of the French papers of Montreal, who had insisted that about my voyage hung all the romance of the days of Cartier and La Salle and Champlain! Bunches of nosegays were tossed down by the bridge-keeper's children at almost every crossing, and one starry-eyed little miss made me come right against the bank to be crowned with a wreath of dandelions. Fain would I have lingered for a prolonged basking in this homage of a Cæsar, but the imminent threat of a renewal of the storm bade me make way while the sun shone.

Hardest of all to renounce was a *ragôut* of delectable savor which a Junoesque *Canadienne* waded out through the matted water-lilies to reach across my stranded bow. And yet even this, after the manner of kings, I did but sniff and remit. Cæsar thrice waved off the kingly crown proffered him by Anthony be-

fore exhibiting symptoms of coyness. I was weakening at a second reaching and would undoubtedly have succumbed to a third. But soft mud and tangled water-lilies are not favorable to maintaining a precarious balance. I grabbed for the hurtling stew-dish but only managed to deflect its tottering bearer against my tilted motor. Juno's father brought her to bank with a boat-hook but all that remained of the *ragôut* was a scum of whitening grease on the soused leaves of the lilies. I can taste that lost stew to this day. There was ecstasy even in the drop that spattered my cheek and trickled down within tongue-tip-reach of the corner of my mouth.

The roar of falling water drummed on the air as the canal wound between green banks in to beautiful old St. John. Standing with craned neck on a thwart, I could just see over the left bank to where the white water was dancing in the first leap of its swift tumbling run down to Lake Chambly. That stretch of rapids avoided by the twelve miles and nine locks of the Chambly Canal is where the principal descent of the Richelieu occurs in its eighty-mile course from Champlain to the St. Lawrence. The fall in the twelve miles between St. John and the foot of the Chambly locks is seventy-four feet, while that at the first lock I had ascended, St. Ours, is only five. Before the dam was built there must have been fast water from not far below the foot of Champlain.

This should have made a fine, sporting but comparatively safe and easy run for the canoes of the Indians and the *bateaux* of the voyageurs.

After locking out into the main river at St. John I found myself in a broad marsh-begirt stretch of almost slack water that was really a northerly extension of Lake Champlain. Here I was exposed to a southerly wind of such force that I had to shut the motor down to half-speed and even then found it necessary to seek the shelter of protected coves twice or thrice to get rid of water that splashed over faster than I could bail it out. Frequent side-channels dissipated the force of the waves as the afternoon wore on, and when I finally won past the Isle de Noix the sun was breaking through the clouds and the wind beginning to lose its force.

Passing the gray stone walls of old Fort Montgomery, once the most advanced of the American border defenses, I ran through a long railway trestle and headed in to Rouses Point to report to the American Customs. Inspection, which consisted of a perfunctory sniff into the door of the forward compartment, was soon over, and I was free to tank-up on American gasoline for the last leg of my voyage.

The declining sun was shining brilliantly by the time I was ready to push off again, and the wind purring gently from the west with barely strength enough to ruffle the darkening water. I had intended

running until dark in the hope of reaching a certain highly attractive camping ground described by the Customs Inspector as at the head of a large island some miles up the lake, but the sight of a picturesque old farmstead occupying a wooded point on the western shore brought me in to the beach before sunset. The cows were being driven in across the meadow as I landed, and the bees were beating reluctant retreat from the sweet clover to the ordered ranks of their hives. And that was what suggested the supper of bread and milk and honey and doughnuts that the gracious farm lady served for me under the apple tree outside the kitchen door.

The place proved to be the historic Point au Fer. It had been a favorite camping ground for the Indians traveling by the "Grand Pass," and there had been some sort of a military station there during the Revolution. Graves of soldiers who had died in a small-pox epidemic that had attacked the post were still found in the woods. Benedict Arnold and Ethan Allen had held conference in the room which formed a wing of the present farm-house. I spread my bed for the night under a century-old elm with leaves so dense that but few of the drops I heard pattering above dampened the outer canvas.

By morning the wind had shifted to the north-east, changing the warm showers of the night to a chill, sodden drizzle. With a following breeze for the first



CAMP ON THE SHORE OF LAKE
CHAMPLAIN



THE REMAINS OF BENEDICT ARNOLD'S
FLAGSHIP AT FORT TICONDEROGA

time in many days I made fast time up the lake in spite of hard steering in the white-caps that kept trying to break over the stern. Point after point slipped past, with the shores growing rockier and more precipitous the farther south I fared. The Adirondacks were to the west and the Green Mountains of Vermont to the east, but with the higher peaks of both ranges only momentarily revealed in the shiftings of the cloud-blankets.

Plattsburg, on the New York side, was abeam a little before noon, and Burlington, Vermont, showed a misty blur of roofs and smoke a couple of hours later. I lunched in the boat without stopping the motor but landed at three in the afternoon at the pretty little village of Essex for gasoline. Here I caught up with a fast motor boat which had passed me at high speed an hour previously. Its owner proved to be a news editor of the *New York Times* by the name of Ruck, making a speed run from his summer home in the Thousand Islands. Although the hull of his boat had been so badly banged up as to start leaking from bumpings in passing the Richelieu locks, he was still good for twenty knots or more and the bubbles of his tumbling wake were the last traces I had of him after he had given me a farewell toot off the Essex dock and disappeared round a towering headland.

I camped for the night on a fine crescent of sandy beach, just across a narrow bay from Fort Henry.

On the hill above were the ruins of an old fort, while the white tower of the Champlain memorial lighthouse crowned a jutting point to the south-east. One of the most beautiful beacons flashing a guiding beam across any waters of the world, the setting of this monumental structure has been badly marred by the failure to remove to a distance the old frame home of the lighthouse-keeper which now stands closely against it.

The north wind had increased greatly in force overnight, kicking up seas in the main lake which would have made navigation very precarious if not impossible. With that part of Champlain remaining to be traversed narrowed to hardly more than the proportions of a good-sized river, however, the waves were too much broken to have dangerous weight behind them. I managed to pass Crown Point without succumbing to the temptation to land, but at beautiful and historic Ticonderoga the lure was too strong. A fine work has been done in restoring the rugged old fortress that commanded the strategically invaluable headland above the meeting of the waters of Lake Champlain and the drainage from Lake George. Not the least interesting relic I found there was the oaken skeleton of the *Revenge*, once commanded by Benedict Arnold and sunk in a fight with the British.

Above Ticonderoga the lake narrowed and shoaled

rapidly, the channel for the last few miles to the entrance of the Champlain Canal at Whitehall being dredged through a continuous marsh. Sounding my horn at the canal inlet, I was told by the lock-master that a pass from the superintendent would be necessary before he could put me through. Running back to a mooring place out of the way of traffic, I tied up my boat and walked half a mile through the town to the administration building. The latter, a fine modern structure of reinforced concrete, appeared to be closed for the day at the unaccountably early hour of three in the afternoon. Inquiry and search finally discovered a man admitting to be from the canal office pitching horseshoes in a nearby vacant lot.

The official appeared not a little peeved at being called away from a game at which he undeniably had a considerable natural aptitude, and peevishness gave way to a real flood of indignation when I stated that my boat was powered only by an outboard motor. Fifteen minutes' thumbing of a book of regulations finally did discover a rule which seemed to hold that only craft with installed motors should be permitted to pass through the canal. In vain did I cite specific instances of outboard powered boats having been passed through the locks of the Panama Canal. Sitting back with thumbs in waistcoat arm-holes and twirling fingers, the guardian of the gates assured me that the Panama Canal was not the New York State

Barge Canal. Equally vain was my plea for a permit on the strength of the fact that I had been given my turn with the ocean-going steamers in the canals of the St. Lawrence. "Them wan't the New York State Barge Canal neether."

Yet it was a little notation on the back of the St. Lawrence pass to the effect that the bearer was a journalist that finally turned the trick.

"Write fer the papers, do yu? Hem—hum. . . . Wal, seein' you've kum so fer, reckon I may as well let yu go on. Allus glad to help reporters."

And so, after meeting with nothing but kindness and courtesy in traversing some hundreds of miles of Canadian canals, I finally won this grudging permission to use the limited stretch of the only one of my own country's canals through which it was necessary to pass to reach the end of my voyage as planned. Save for an officious roustabout at one of the locks, the rest of those with whom I came in contact in passing through the Champlain Canal were friendly and courteous. Doubtless the political appointee is found only in the administrative offices. The real source of the New York State Barge Canal is, of course, Albany, which would account for the fact that rather more politics than shipping passes through its channels.

Returning to my boat, I found the motor a near-wreck as a consequence of having been started up by

a predatory gang of street gamins a few minutes previous to my arrival. After the outraged little craft had tried vainly to shake off its tormentors by climbing the bank, it had attempted to defeat their end by tangling the tiller-lines in the fly-wheel and stalling the motor. The ambitious young pirates were busily engaged in prying loose the strangle-hold of the braking rope when I landed in their midst from the wall above.

My timely appearance probably saved a chase after my glasses and cameras, all of which had been extracted from their cases. More important still, it had prevented further jack-knife surgery on the motor. An operation already under way considerably altered the action of the timer, which was never quite its former pepful energetic little self again. A hurried inventory not only disclosed nothing of any kind to be missing, but that, on the contrary, I was ahead one knife, two hats, a bag of all-day-suckers and the back of a shirt retained in my fist after a well-meant grab at a diving fugitive.

Coming on top of my not unannoying visit to the canal office, I was rather the more inclined to think of the raid of this little gang of youthful Yankees in the light of the many times my boat had remained unmolested along a thousand miles of Canadian waterways. My "Home-coming Week" was making a far from auspicious start. It is only fair to add, how-

ever, that, on the score of human contacts, this was the only unsatisfactory day of the whole voyage. Whitehall is an industrial town—silk-mills—and there isn't really much to choose between the street gamins of manufacturing centers the world over.

Locked up through a fifteen-foot lift, I ran through the heart of the town and out into a rich and beautiful farming country. A lift of twelve feet at Comstock, with one of sixteen feet at Smith's Basin, brought me to the crest of the divide between Champlain and the Hudson. Camping for the night on the grassy canal bank, I pushed off early and ran through to Schuylerville by mid-forenoon. That gave me time for a climb to the splendid scenic vantage of the General Schuyler monument and a drive to the historic points associated with Burgoyne's surrender.

Many locks made slow going in the afternoon and the day was well advanced before I came out of the last of those of the Champlain system at Waterford and ran on down past the entrance of the Erie Canal and the mouth of the Mohawk. There still remained the great Government lock at Troy and an hour was lost here while a long tow of barges from Buffalo went in and out ahead of me. Tailing on to the last of these while the water sunk, I learned from the resident family that, as a consequence of trouble with the

engine of the towing barge, they had been several weeks passing through the Erie Canal.

I spent the night on a narrow gravel island immediately opposite the heart of Troy. The steeply sloping bank was saturated some distance above the level at which I landed, but it was not until my grounded boat had floated free several times that the reason for it came home to me. There is a rise and fall of tide of a number of feet right at the foot of the Troy dam, which brings home the interesting fact that the Hudson—the lordly Hudson of song and story—is really not a full-grown river at all, but rather only a sizeable creek with an extremely long and narrow estuary. The tides run up and down the hundred and fifty mile-long arm of the sea as the impulses undulate along a shaken rope. Thus it may, for instance, be high-tide at Troy at the same time it is low-tide at New York.

Yet the Hudson is not any the less beautiful because the best known and most admired part of it is really no more than an attenuated tidal reach. Of all the great rivers of the world which I can recall off-hand, only the Columbia—and possibly the Min, in central China—comes to the sea in a more impressive scenic setting.

The tide turned some time after midnight and, shoving off in the first flush of the dawn, I drifted down to Albany on the ebb. I had known of Troy in a vague

sort of way as the center of the American collar and shirt trade, but how great an industrial concentration this really was I did not realize until—magnified by the morning mists—I discovered looming above great buildings which were marked as being Plants Number Six and Seven, and so on up to somewhere in the teens, of a certain well known manufacturer of linen wear. How far specialization in neckwear has been carried at Troy may be judged from the fact that the sign on one big plant revealed that it was devoted exclusively to the making of horse-collars!

Discovering it was Sunday on arrival at Albany, I found I would have to wait until the express office opened the following morning to get a bag which had been shipped there with my civilized togs. The watchman at the Albany Yacht Club found a berth for the boat, which left me free for a drive around the city and through a very beautiful countryside to Schenectady. That dispensed by the Albany Yacht Club comes nearer to literally wide-open hospitality than anything of that brand I have ever encountered. Not only are motor-boats and motor-cruisers extended the privileges of mooring room and the clubhouse without the formality of being put up by a member, but even canoeists are made equally at home. A dozen of these had slept on the club-house porch the night previous to my arrival. One's craft appears to be one's card at this hospitable club, the privileges



ON THE NEW YORK STATE BARGE CANAL



MY BOAT FINALLY AT REST—THE TRIP OVER

of the island home of which are all the more welcome because there are no practicable moorings anywhere else along the water-front.

A strong adverse tide and wind made slow and sloppy going when I resumed my voyage on Monday, July 28th. By the time the tide finally turned in my favor the up-stream wind had increased to a force which more than offset the advantage. What with the buffetings of head-waves and frequent stops for bailing, I had made but little over forty miles for the day when I landed in the deepening twilight where the log river-wall of an old ice-house offered a safe mooring for the night. A fisherman who strolled over for a yarn while I was cooking supper revealed the interesting fact that I had made camp on the Hudson frontage of the old Bigelow homestead, an estate which had been in the hands of that distinguished family since Revolutionary days. Poultney Bigelow, the present owner, who had been entertaining a house-party of friends from New York and Boston, had cut his foot with an ax the previous day and was now confined to his bed.

Sharing many friends on both sides of the Atlantic with the "Sage of Malden," I could not let the occasion pass without at least leaving a message of condolence at the door. That led to a yarn at the bedside of Mr. Bigelow (whose cloven toe did not prevent his treading in fancy with me ends-of-the-earth

pathways we had known in China, Borneo and New Guinea), followed by an invitation to hang on for a day or two with the house-party. Compromising on *café-au-lait* and raspberries and cream on the veranda at seven in the morning, a forenoon among the Bigelow books and pictures and an early lunch, I pushed off in the afternoon of the following day with a favoring tide. Passing Kingston, Poughkeepsie and Newburgh, I ran in through a driving rain-storm to Chelsea, mooring for the night to the float of the little water-front park.

The spray from breaking waves routed me out of my bed on the sea-wall before daylight, but only to face a tedious wait of a couple of hours until my stranded boat was floated by the rising tide. The remainder of the day was a ding-dong fight against one of the heaviest blows I had encountered since the big storm on the north shore of Lake Michigan. This did not trouble me seriously while I banged down the comparatively narrow reaches past West Point, Peekskill and Haverstraw, but when I entered the broad lake-like expanse below the rusting lines of the moored ships of the Emergency Fleet Corporation I soon found the boat, even with the motor at half-speed, was taking more water than I could comfortably get rid of.

Running in toward the eastern shore to make landing easier in case of swamping, a huge gray building

which I took to be a factory appeared out of the mists. The name of the place on the map, Ossining, meant nothing to me—until some men with guns on their shoulders rushed down to disperse some other men in striped clothes who were crowding against a high iron fence to watch my approach. Both guards and guarded appeared to scent a possible jail delivery.

Tarrytown was my immediate objective, and the sentry who waved me off had shouted, in reply to my query, that Tarrytown light was six miles farther down. With heavy seas crashing against my star-board beam, I lost ground steadily with my bailing all the way, though without serious worry on account of the nearness of the shore. Suddenly the wind shifted to the southeast, creating a wild wallow of cross seas which brought water over impartially from either side. There was a crazy mob of waves rioting off the point above Tarrytown, and running through the shallows inside the light avoided only the worst of them.

With Tarrytown breakwater and the anchored fleet off the boat-club in sight, the wind hauled back eight points to the south-west and settled down to a blustering blow of from forty to fifty miles an hour. Ten minutes of such a gale in mid-river would have meant certain swamping, and even as it was there was a bit of doubt as to whether or not the boat would fill before I reached more sheltered water. The last

three hundred yards was a real monkey-show. The waves thrown off from the river-wall in front of the Chevrolet works, colliding with the intrushing rollers driven before the wind, formed tossing fountains of water, that shot straight up into the air and then tumbled back on themselves.

With several hundred potential life-savers from the big motor factory lining the wall to see the fun it really didn't matter a lot if the boat did swamp; and so I kept plugging ahead with the gunwales setting lower at every wave. By the time I had rounded the breakwater my freeboard was reduced to just about that of a floating plank. Yet in spite of the indignant sputtering and spitting induced by being buried almost to the cylinders, my game little motor still rattled merrily on. With the water swirling about my knees, it took a nice bit of balancing to keep the boat on a sufficiently even keel to steer, but this was managed sufficiently well to bring it in alongside the clubhouse landing.

Dodging through the anchored boats, I could see that several of them were dragging their moorings, while one motor-boat and several skiffs were already on the beach. As landing on the plunging float was out of the question without help, I worked on shoreward under oars and finally contrived a temporary mooring in the partly sheltered water in the lee of the piling supporting the club-house.

A telephone call to the Commodore of the boat-club at his place of business, the local Standard Oil station, brought him down at once to give me a hand. With the help of the steward of the club and a hundred feet of heavy line, we contrived a mooring which promised to weather the blow. The engine was detached and the canvas hood extended all the way back over the stern. Held by half-inch bow and stern-lines, it looked as though nothing short of being run down by a drifting motor-cruiser from the outer anchorage could cause trouble.

Some time in the night, however, when the gale was at its height, the bow-line must have chafed through. Just what happened I never learned, but it is quite probable that the near-derelict rode out the night at the end of her stern-line. Then some good soul, whom I have never had the opportunity to identify and thank, moored her all over again. She was lying snug and uninjured when I came back to finish my voyage thirty-six hours later, with only a few inches of water in her bilge to show for the experience.

That night, for only the second time on my voyage, I slept between sheets again. The previous evening I had inflated my rubber mattress on a stone river-wall, to be drenched before morning with the wind-blown tops of breaking combers. Now I rolled into a canopied four-poster that my good friends, the Gino Speranzas of Irvington, had recently bought in Italy

at one of the recurrent bankrupt sales of Gabriele d'Annunzio. I slept well enough on both occasions. The only difference was that the D'Annunzian draperies cut down the supply of oxygen from my hitherto wind-fanned lungs to such an extent that I contracted prematurely the returning-to-civilization cold that every home-coming camper learns to expect as a matter of routine.

The gale had blown itself out by the time I took the river again at midday of August first. The day was hot, windless and sultry, with afternoon thunder squalls in the offing. I made fast time running down the Hudson with the ebb, but on entering the Harlem at Spuyten Duyvil this favoring flow became a head-tide. I fought a current of six or seven knots in breasting the broken water under the railway trestles at the mouth of the river and an average of more than half of that all the way through to Mott Haven.

A wild howling from a baseball park which I took to be the new Yankee Stadium told of a home-run to the bleachers, or possibly a brilliant catch retiring the hated visiting team. Then a violent thunder shower, breaking at almost the same moment I nosed into a foul reach stiff with floating street sweepings, created the momentary illusion that it was really raining the cats and dogs among which I bumped. Then the sun came out again and I found myself presented with the choice of two channels leading into the broad

expanse of open water separating the Bronx and Long Island.

Choosing the nearer and narrower of the passages because it was the shorter, I found myself bucking a current which, in mid-stream, I could barely hold my own against with the motor wide open. Dodging up through the eddies along the banks, I made much better time, passing several launches that had moored to await the turn of the tide.

Landing at a boat-house where the waters began to broaden and the current to slacken, I learned that I had just come through the narrower, and therefore the swifter, channel of Hell Gate. The boat-house people said they had never heard of the full force of the tide having been successfully breasted before by an outboard motor. As they seemed considerably impressed, I thought it just as well not to spoil things by explaining how simple it really is to work up against a fast current by keeping to the swirls and eddies.

The previous day I had arranged by telephone to have my outfit stored and cared for at the boat-house of Bruno Beckhard at Flushing. With the course all the way into Flushing Bay opening up straight ahead, I did not wait for the launch which was to have come to the Harlem to pilot me in. Beckhard was waiting for me at his landing below the bridge that closes the end of the shallow arm running in from the bay.

"I've been anxious for you to come," he said with a

grin, "so that I could borrow your Elto for a demonstration run. All of my own are in use this afternoon. Hope you won't mind."

It was rather a mean trick to play on a poor little kicker that had just finished driving fifteen hundred pounds or more of boat and outfit through almost two thousand miles of not always tranquil waters; but if there was any bitterness in its game spirit there was no trace of it in the snappy rat-a-rat with which it responded to the first spin of its bright fly-wheel. Five minutes later the red canoe it was driving had disappeared in the direction of the Sound.

I had packed up and taken train for New York before the demonstration run was over, and so never had a chance to tell that astonishing little bundle of energy to its face just how I felt about the way it had served me, especially on those three or four occasions on which its failure would have meant the bringing to an end of more than my voyage. As so many flattering things were said to and about it at the January Motor Boat Show in New York, it will perhaps be just as well if I refrain from expressing myself until I see it again. But replying to many hundreds who have written me about it, I will only say that that two thousand mile run without a single replacement should speak for itself.

APPENDIX

RIVER, LAKE AND CANAL DISTANCES AND LOCK DATA ON ALL-WATER ROUTE BETWEEN NEW YORK AND GEORGIAN BAY

(From "The Canal Systems of New York State," issued by the Superintendent of Public Works of New York, and "The Canals of Canada," issued by the Department of Railways and Canals.)

NEW YORK TO MONTREAL

The passage from New York City to Montreal would cover the following route:

Up the Hudson River to the United States Government lock at Troy (151.93 miles); through the Champlain Canal to Lock No. 12 at Whitehall, 62.86 miles; along the Lake Champlain Inlet or "Narrows," 14 miles into Lake Champlain, and thence to the Canadian boundary line, 97.75 miles. From this point northerly, the navigable channels are under the jurisdiction of the Dominion Government. The River Richelieu is followed downstream, 23 miles, to the entrance to the Chambly Canal at St. Johns. From St. Johns the canal extends to the Chambly Basin, a distance of 12 miles. Nine locks will be encountered, the shortest having a length of 118 feet and a width from $22\frac{1}{2}$ to 24 feet. The depth of water on sills is $6\frac{1}{2}$ feet with a width of canal at bottom of 36 feet and at surface of 60 feet. At Chambly Basin, the northerly end of the canal, the River Richelieu is again entered and navigated 32 miles to the St. Ours Lock, which has

dimensions 200 feet by 45 feet, with a depth on sills of seven feet. From the St. Ours Lock to Sorel, through the River Richelieu, is 14 miles. At Sorel the Richelieu joins the St. Lawrence River and by way of the St. Lawrence, from Sorel to Montreal, is 46 miles. The total distance from New York City to Montreal is 453.21 miles.

Other points on the St. Lawrence River may be reached from New York Harbor by continuing along the above route or by way of the Erie and Oswego Canals to Lake Ontario and thence across the lake to the river entrance at Cape Vincent or Kingston.

DISTANCES ON HUDSON BETWEEN NEW YORK AND CHAMPLAIN CANAL

	Place to place	From New York
New York City, pier 5 and 6, East river		0.0
Yonkers	18.0	18.0
Dobbs Ferry	5.3	23.8
Erie railroad docks	2.2	26.0
Tarrytown	2.3	28.3
Nyack	.9	29.2
Ossining	4.6	33.8
Haverstraw	4.0	37.8
Peekskill	7.1	44.9
West Point	7.4	52.3
Cold Spring	2.6	54.9
Cornwall Landing	2.6	57.5
Newburgh	3.6	61.1
Fishkill	.3	61.4
New Hamburg	6.4	67.8
Poughkeepsie	7.9	75.7
Kingston, on side line 1.2 miles long	16.4	92.1
Rhinecliff	15.3	91.0
Saugerties	10.5	101.5
Catskill	10.6	112.1

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Athens	4.1	116.2
Hudson	.2	116.4
Coxsackie	6.9	123.3
New Baltimore	6.4	129.7
Coeymans	2.0	131.7
Castleton	4.0	135.7
Rensselaer, Ferry street	7.7	143.4
Albany, Madison avenue	0.4	143.8
Albany terminal	1.0	144.8
Rensselaer, Forbes Avenue	1.0	144.8
Troy, Washington street terminal	5.1	149.9
Watervliet, at ferry	.2	150.1
Troy, upper terminal	.4	150.5
Troy, Federal lock	1.43	151.93
Cohoes terminal, Ontario street	1.67	153.60
Mohawk river below Union bridge	.78	154.38
Waterford—junction Erie and Champlain canals	.78	154.38

DISTANCES ON THE CHAMPLAIN CANAL AND LAKE CHAMPLAIN

	Distance between points	From New York	From Canadian line
Federal lock at Troy		151.93	174.71
Cohoes terminal, Ontario street ...	1.67	153.60	172.9
Waterford junction in river	.78	154.38	172.12
Waterford, Union bridge	.54	154.92	171.58
Lock No. 1	2.88	157.80	168.70
Lock No. 2	3.90	161.7	174.8
Mechanicville terminal	1.90	163.6	162.9
Lock No. 3	.63	164.23	162.27
Lock No. 4	1.83	166.96	160.44
Stillwater, bridge	.42	166.48	160.02
Bemis Heights	2.82	169.30	157.20
Lock 5 and Junction Lock	11.06	180.36	146.14
Junction lock to Schuylerville Basin	1.2	181.56	147.34
Thomson terminal	1.04	181.4	145.10
Northumberland bridge	.10	181.5	145.0
Lock No. 6, Fort Miller	2.50	184.0	142.5
Guard gate (Crocker's Reef)	2.07	186.07	140.43

Lock No. 7, Fort Edward	5.17	191.24	135.26
Fort Edward terminal, side line ...	1.00	192.24	136.26
Lock No. 8	2.06	193.30	133.20
Dunham's Basin, bridge	1.70	195.00	131.50
Lock No. 9	4.10	199.10	127.40
Smith's Basin, bridge	.44	199.54	126.96
Fort Ann, bridge	3.76	203.30	123.20
Comstock, bridge	3.94	207.24	119.26
Lock No. 11	.96	208.2	118.3
Whitehall terminal	6.30	214.5	112.0
Whitehall lock No. 12	.29	214.79	111.71
Ticonderoga	22.31	237.1	89.4
Crown Point	8.30	245.4	81.10
Port Henry	8.10	253.5	73.0
Essex	21.00	274.5	52.00
Burlington	11.00	285.5	41.0
Port Kent	3.00	288.5	38.0
Plattsburg	12.00	300.5	26.0
Rouses Point	24.5	325.	1.70
Canadian line	1.70	326.7	...

ELEVATIONS AND LIFTS ON THE CHAMPLAIN CANAL

		Miles from Troy Dam	ELEVATION OF WATER SURFACE		Lift of lock in feet
			Above lock	Below lock	
1.....	Waterford	5.8	29.5	15.2	14.3
2.....	Mechanicville	9.7	48.0	29.5	18.5
3.....	Mechanicville	12.3	67.5	48.0	19.5
4.....	Stillwater	15.0	83.5	67.5	16.0
5.....	Northumberland ...	28.5	102.5	83.5	19.0
6.....	Fort Miller	33.0	119.0	102.5	16.5
7.....	Fort Edward	39.3	129.0	119.0	10.0
8.....	Fort Edward	41.3	140.0	129.0	11.0
9.....	Smith's Basin	47.0	140.0	124.0	16.0
11.....	Comstock	56.2	124.0	112.0	12.0
12.....	Whitehall	62.8	112.0	96.5	15.5

The improved Champlain Canal, between Troy and Lock No. 7, at Fort Edward, depends for its water supply on the Hudson River, within whose bed this portion of the canal lies. The highest or summit level is found between Lock No. 8, at Fort Edward, and Lock No. 9, at Smith's Basin. Into this flows water from the Glens Falls Feeder, which derives its supply from the Hudson River at Glens Falls. From Smith's Basin the route north lies largely in the valley of Wood Creek and the required depth is maintained by small tributary rivers and creeks whose natural flow is northward.

From the standpoint of water supply and probable number of lockages which would be required with maximum use, the capacity of the improved canal system is estimated to be sufficient for the transportation of 20,000,000 tons per season.

DISTANCES, ALBANY TO MONTREAL BY WAY OF HUDSON RIVER, LAKE
CHAMPLAIN AND RICHELIEU AND ST. LAWRENCE RIVERS
(APPROXIMATE DISTANCES)

	Place to place	Total distances
Albany		
Whitehall	70	70
Rouses Point	110	180
St. John's (canal entrance)	25	205
Chambly	12	217
St. Ours Lock	32	249
Sorel	14	263
Montreal	46	309

RICHELIEU RIVER TO LAKE CHAMPLAIN ROUTE

This system, commencing at Sorel, at the confluence of the Rivers St. Lawrence and Richelieu, 46 miles below Montreal,

extends along the River Richelieu, through the St. Ours Lock to the basin at Chambly; thence, by the Chambly Canal, to St. Johns, and up the River Richelieu to Lake Champlain. The distance from Sorel to the boundary line is 81 miles. Minimum depth of water is 6 feet 6 inches.

At Whitehall, at the southern end of Lake Champlain, connection is obtained by means of the Champlain Canal with the River Hudson, by which the city of New York is directly reached.

ST. OURS LOCK AND DAM

Length	0.12 mile.
Number of locks	1
Dimensions of lock	200 feet by 45 feet.
Total rise or lockage	5 feet.
Depth of water on sills	7 “
Length of dam in western channel .	690 “
Minimum overhead clearance	No restrictions.

At St. Ours, 14 miles from Sorel, the River Richelieu is divided by a small island into two channels. The St. Ours Lock is in the Eastern channel.

There is a navigable depth in the Richelieu of 7 feet between St. Ours Lock and Chambly Basin, a distance of 32 miles. Depth of water on lower sill is governed by level of St. Lawrence River and has been as low as 4 ft. 11 inches in 1895.

CHAMBLY CANAL

Length of canal	12 miles.
Number of locks	9

Dimensions of locks—

Guard lock No. 1 at St.		
Johns	122	feet.
Lift lock No. 2	124	"
Lift locks Nos. 3, 4, 5, 6 ...	118	"
Lift locks Nos. 7, 8, 9, com-		
bined	125	"
Total rise or lockage	74	"
Depth of water on sills	6½	"
Breadth of canal at bottom ...	36	"
Breadth of canal at surface of		
water	60	"
Minimum overhead clearance ..	124	(Transmission lines)

} From 22½
to 24 feet
wide.

This canal succeeds the 32 miles of navigable water between St. Ours Lock and Chambly Basin. The canal overcomes the rapids between Chambly and St. Johns.

RIVER ST. LAWRENCE AND GREAT LAKES ROUTE

The River St. Lawrence, with the system of canals established on its course above Montreal, and the Lakes Ontario, Erie, St. Clair, Huron, and Superior, with connecting canals, afford a course of water communication extending from the Strait of Belle Isle to Port Arthur or Fort William on the west coast of Lake Superior, a distance of 2,217 statute miles. The distance to Duluth is 2,339 miles; the distance to Chicago 2,243 miles. From the Straits of Belle Isle, at the mouth of the St. Lawrence, to Montreal, the distance is 1,003 statute miles. From Quebec to Montreal the distance is 160 miles.

The control of the St. Lawrence Ship Channel, and the making of improvements thereto, are now under the Department of Marine and Fisheries, whose annual reports give full information as to the history and improvement of the channel. A 30-foot channel between Montreal and Father Point—with a width of 450 feet in the straight portions, and of from 600 to 750 feet in the bends between Montreal and Quebec, and of 1,000 feet everywhere below Quebec—has been practically completed. In 1909 the first work of deepening the ship channel to 35 feet was begun.

By means of channel improvements, Montreal has been placed at the head of ocean navigation, and here the canal systems of the River St. Lawrence begin, overcoming the several rapids by which the river channel upwards is obstructed, and giving access through the St. Lawrence canals, the Welland Canal, the Great Lakes and the Sault Ste. Marie Canal to the head of Lake Superior.

The difference in level between the point on the St. Lawrence, near Three Rivers, where tidal influence ceases, and Lake Superior, is about 600 feet.

The Dominion canals, constructed between Montreal and Lake Superior, are the Lachine, Soulanges, Cornwall, Farran's Point, Rapide Plat, Galops, Murray, Welland, and Sault Ste. Marie. Their aggregate length is 74 miles; total lockage (or height directly overcome by locks), 553 feet 3 inches. The number of locks through which a vessel would pass in its passage from Montreal, at the head of ocean navigation, to the head of Lake Superior, is forty-eight. The Soulanges Canal takes the place of the Beauharnois Canal,

abandoned for navigation purposes. The Murray Canal, a level water way without locks, is used only by the coasting vessels on Lake Ontario and it is not a part of the through route.

It is important to note that the enlargement of canals on the main route between Montreal and Lake Erie comprises locks of the following minimum dimensions: length, 270 feet; width, 45 feet; depth of water on sills, 14 feet. The length of vessels to be accommodated is limited to 255 feet. At Farran's Point, in the canal of that name, the lock is 800 feet long. A similar lock is built at Iroquois, on the Galops Canal, the object being to pass a full tow at one lockage. The lock at Sault Ste. Marie is 900 feet by 60 feet, with 18 feet 3 inches on the sills at lowest known water level.

Access from Lake Erie to Lake Huron is obtained by way of the Detroit River, Lake St. Clair, and the St. Clair River, which have been deepened to a minimum of 21 feet, principally by the United States Government.

Communication between Lakes Huron and Superior is obtained by means of the Canadian Sault Ste. Marie Canal, and also by the St. Mary's Falls canals, situated on the United States side of the River St. Mary. Improvements of the United States channels in River St. Mary through Hay Lake, east of Sault Ste. Marie, have been carried on for several years past. The dredged areas now total 34 miles in length, with a minimum width of 300 feet, which is increased at angles and other critical points to 1,000 feet. The depth is 20 feet at the mean stage of water. In the year 1903,

excavation was commenced to give 21 feet at the lowest stage of water.

The improvement of Canadian channels from above Montreal to the head of Lake Superior is controlled by the Department of Public Works. Work is now under way to dredge the channel in the River St. Mary to 21 feet 6 inches below low water level, the existing minimum depth being 18 feet 9 inches below low water level. Existing depths elsewhere between Lakes Erie and Superior give a minimum of 20 feet below low water level. The Limekiln channel in the Detroit River has been deepened to 21 feet; and the United States Government has opened the Livingstone Channel in the same (Detroit River) with a depth of 22 feet.

The improvements at the harbors of Fort William and Port Arthur now under way will give a minimum depth of 25 feet below low water level. This depth exists at present over the channels leading to the principal wharves.

The provision and maintenance of aids to navigation on all Canadian river and lake channels is controlled by the Department of Marine and Fisheries.

The Sault Ste. Marie, Welland, Cornwall, Soulanges and Lachine canals are well lighted throughout by electricity, and are electrically operated. The Farran's Point Canal is lighted with acetylene gas.

Navigation, which is closed by ice during the winter months, opens about the end of April on the Great Lakes and St. Lawrence route. Ice-breaking steamers are now employed to lengthen the navigable season at Lake Superior and Georgian Bay terminals and also on the St. Lawrence River between Quebec and Montreal.

STATEMENT OF PRESENT MINIMUM DEPTH OF
IMPROVED CHANNELS

Father Point to Montreal	30 feet
Montreal to Port Colborne	14 “
Port Colborne to Fort William	18 “ 9 inches.

LACHINE CANAL

Length of canal	8.5 statute miles
Number of locks	5
Dimensions of locks	270 feet by 45 feet
Total rise or lockage	45 feet
Depth of water on sills:—	
Lock No. 1 { Normal	18 feet
{ Extreme low water	14 feet 5 inches
Lock No. 2	18 feet
Locks Nos. 3, 4 and 5	14 “
Average width of canal	150 “
Minimum overhead clearance	148 “ (Trans- mission line)

The canal consists of one channel with two distinct systems of locks, the old and the new or enlarged. There are two lock entrances at each end. The above table applies to the new system only.

The old locks are still available for navigation. Nos. 1 and 2 (on north side) have been enlarged to 270 feet in length and under ordinary water conditions both have 15 feet 10 inches of water on mitre sills. At extreme low water in Montreal Harbor, however, old lock No. 1 has 12 feet 3

inches only. Old locks Nos. 3, 4 and 5 are 200 feet by 45 feet with only 9 feet of water on sills.

The canal extends from the city of Montreal to the town of Lachine, overcoming the St. Louis Rapids, the first of the series of rapids which bar the ascent of the river St. Lawrence. They are 986 miles distant from the strait of Belle Isle.

This canal is lighted by electricity. The necessary apparatus for the electrical operation of all the locks is installed.

From the head of the Lachine Canal to the foot of the Soulanges Canal the distance is 16 miles.

SOULANGES CANAL

Length of canal.....	14 statute miles
Number of locks—	
Lift	4
Guard	1
Dimensions of locks.....	280 feet by 45 feet
Total rise or lockage.....	84 feet
Depth of water on sills....	15 “
Breadth of canal at bottom	100 “
Breadth of canal at water surface	164 “
Minimum overhead clearance	141 “ (Telephone wires)

The canal extends from Cascades Point to Coteau Landing, overcoming the Cascades Rapids, Cedar Rapids, and Coteau Rapids.

The locks on this canal are electrically operated and the canal lighted by electricity.

From the head of the Soulanges Canal to the foot of the Cornwall Canal there is a stretch through Lake St. Francis, 31 miles, which is navigable for vessels drawing fourteen feet.

CORNWALL CANAL

Length of canal.....	11.25 statute miles
Number of locks.....	6
Guard gates.....	1
Dimensions of locks....	270 feet by 45 feet
Total rise or lockage....	48 feet
Depth of water on sills..	14 “
Breadth of canal at bottom	90 “
Breadth of canal at water surface	154 “
Minimum overhead clearance	150 “ (Transmission line)

The Cornwall Canal extends past the Long Sault Rapids from the town of Cornwall to Dickinson's Landing.

The locks on this canal are electrically operated and the canal lighted by electricity.

From the head of the Cornwall Canal to the foot of Farran's Point Canal the distance on the River St. Lawrence is five miles.

WILLIAMSBURG CANALS

The Farran's Point, Rapide Plat and Galops canals are collectively known as the Williamsburg canals.

FARRAN'S POINT CANAL

Length of canal.....	1.25 statute miles
Number of locks.....	1
New lock.....	800 feet by 50 feet
Total rise or lockage.....	3 feet 6 inches
Depth of water on sills of new lock	14 “
Depth of water on sills of old lock	9 “
Breadth of canal at bottom....	90 “
Breadth of canal at water surface	154 “
Minimum overhead clearance....	No restrictions

This canal enables vessels ascending the river to avoid Farran's Point Rapids, passing the full tow at one lockage. Descending vessels run the rapids with ease and safety.

The canal is lighted by acetylene gas.

From the head of Farran's Point Canal to the foot of Rapide Plat Canal there is a navigable stretch of 9½ miles.

RAPIDE PLAT CANAL

Length of canal.....	3.66 statute miles
Number of locks.....	2
Dimensions of locks.....	270 feet by 45 feet
Total rise or lockage.....	11 feet 6 inches
Depth of water on sills.....	14 “
Breadth of canal at bottom....	80 “
Breadth of canal at water surface	152 “
Minimum overhead clearance....	No restrictions

The old lift-lock, 200 feet by 45 feet, is also available with nine feet of water on mitre sills.

The canal was formed to enable vessels ascending the river to pass the rapids at that place. Descending vessels run the rapids safely, except at extreme low stage of water in river, when vessels of full canal draught use the canal down bound.

From the head of Rapide Plat Canal to Iroquois, at the foot of the Galops Canal, the St. Lawrence is navigable $4\frac{1}{2}$ miles.

GALOPS CANAL

Length of canal.....	7.33 statute
Number of locks.....	3 miles
Dimensions of locks—	
Lift-lock at foot of canal.....	800 by 50 feet
Guard-lock at head of canal.....	270 by 45 feet
Lift-lock to pass vessel around Galops	
Rapids only	303 by 45 feet
Total rise or lockage.....	15 ft. 6 in.
Depth of water on sills.....	14 feet
Breadth of canal at bottom.....	80 “
Breadth of canal at surface of water..	144 “
Minimum overhead clearance.....	No restrictions

This canal enables vessels to overcome the rapids at Pointe aux Iroquois, Point Cardinal and the Galops.

WELLAND CANAL

Port Dalhousie, Lake Ontario, to Port Colborne, Lake Erie.

Length of canal.....	26.75 miles.
Pairs of guard-gates....	1

Number of locks—

Guard	1
Lift	25
Dimensions	270 feet by 45 feet.
Total rise or lockage....	326 feet 9 inches
Depth of water on sills....	14 feet
Minimum overhead clear-	
ance	150 “ (Transmission line)

WELLAND RIVER BRANCHES

Length of canal—

Port Robinson cut to River	
Welland	2,622 feet.
From the canal at Welland to	
the river, via lock at Aque-	
duct	300 “
Chippawa cut to River Niagara	
(6 feet navigation only) ..	1,020 “
Number of locks—one at Aque-	
duct and one at Port Rob-	
inson	2
Dimensions of locks.....	150 feet by 26.5 feet.
Total lockage from the canal	
at Welland down to River	
Welland	10 feet
Depth of water on sills.....	9 feet 10 inches.
Minimum overhead clearance..	50 feet.

GRAND RIVER FEEDER

From Port Maitland to Stromness and Dunnville.

Length of canal.....	6.25 miles.
Number of locks.....	2
Dimensions of locks.....	{ 1 of 185 by 45 feet. 1 of 300 by 26.5 feet.
Total rise or lockage.....	7.5 feet.
Depth of water on sills.....	6 “ only
Navigable depth of channel..	5 “
Minimum overhead clearance..	4.5 “ (Fixed bridges)

The locks on this canal are electrically operated and the entire canal lighted by electricity.

From Allanburg to Port Colborne, a distance of 15 miles, there is only one channel, the old canal having been enlarged.

From the head of the Welland Canal there is deep water navigation through Lake Erie, the Detroit River, Lake St. Clair, the St. Clair River, Lake Huron and River St. Mary to Sault Ste. Marie Canal, a distance of about 580 miles. From Sault Ste. Marie Canal the distance through Lake Superior to Port Arthur is 274 miles, and to Duluth 397 miles.

WELLAND SHIP CANAL

The Welland Ship Canal, now under construction, follows the course of the present canal from Port Colborne, on Lake Erie, to Allanburg, half-way across the peninsula. From this point an entirely new cutting is to be made, crossing the present canal just below lock No. 25, the water level of the two canals at this point being the same, viz: 568 feet above sea-level. The new canal again crosses the present one below lock No. 11, the water of both canals at this point being at an elevation of 382 feet above sea-level.

The proposed canal enters Lake Ontario at the mouth of the Ten-mile creek, about 3 miles east of Port Dalhousie, the entrance to the present canal. The total length of the canal from lake to lake is 25 miles; the difference in level between the two lakes, $325\frac{1}{2}$ feet, is to be overcome by seven lift-locks, each having a lift of $46\frac{1}{2}$ feet. The dimensions of the locks are to be 800 feet in length by 80 feet in width in the clear and with 30 feet of water over the mitre sills at extreme low stages of water in the lakes. The width of the canal at the bottom will be 200 feet and, for the present, the canal reaches will be excavated to a depth of 25 feet only, but all structures will be sunk to the 30-foot depth, so that the canal can be deepened at any future date by the simple process of dredging out the reaches.

SAULT STE. MARIE CANAL

Length of canal, between the extreme ends of the en- trance piers.....	1.30 miles or 7,472 feet
Number of locks.....	1
Dimensions of lock.....	900 feet by 60 feet at water level; width at lock bottom, 59 feet
Depth of water on sills (at low- est known water level)...	18 feet 3 inches
Total rise or lockage (mean)...	19 feet
Breadth of canal at bottom..	141 feet 8 inches
Breadth at surface of water..	150 feet
Minimum overhead clearance..	No restrictions

This canal has been constructed through St. Mary's Island, on the north side of the rapids of the River St. Mary, and, with that river, gives communication on Canadian territory between Lakes Huron and Superior. This canal is the last on the St. Lawrence and Great Lakes route.

The lock on this canal is electrically operated and the canal lighted by electricity.

MURRAY CANAL

Length between eastern and western piers	5.17 miles
Breadth at bottom.....	.80 feet
Breadth at water surface, low water, Lake	
Ontario	124 feet
Depth below low water, Lake Ontario....	11 feet
Number of locks.....	None
Minimum overhead clearance.....	125 feet
	(Transmission line)

This canal extends through the Isthmus of Murray, giving connection westward between the head waters of the Bay of Quinte and Lake Ontario, and thus enabling vessels to avoid the open lake navigation between Kingston and Presque Isle light on north shore Lake Ontario.

THE TRENT CANAL

GENERAL

The term "Trent Canal" is applied to a series of navigable rivers and lakes connected by short canals, forming a continuous system of navigation for 204 miles from Lake Ontario to

Washago at the northern end of Lake Couchiching. Smaller boats may even now proceed down the Severn River to Lake Huron, 235 miles from Trenton. With the completion of the Severn Division 6-foot navigation will be possible from Lake Ontario to Lake Huron. The maximum size of vessel which can be accommodated is limited by the size of the old lock at Young's Point to 117 feet by 32 feet by 6 feet, or if of square scow build, 104 feet by 31 feet by 6 feet.

The navigation system embraces, in order, the following rivers and lakes extending from the town of Trenton, on the Bay of Quinte, to Port Severn, on the Georgian Bay: Trent River, Rice Lake, Otonabee River, Katchawano, Clear, Stoney, Lovesick, Deer, Buckhorn, Chemong, Pigeon, Sturgeon, Cameron and Balsam Lakes, (summit) Mitchell Lake, Talbot River, Lake Simcoe, Lake Couchiching, Sparrow Lake, Severn River, and Gloucester Pool, also Scugog River and Lake Scugog. It follows closely the course contemplated many years ago, for as early as 1827 this navigation system was proposed. Only $32\frac{1}{4}$ miles are excavated canal prism.

The full execution of the scheme, commenced in 1833 by the Inland Water Commission acting under appointment from His Excellency Sir John Colborne, Lieutenant-Governor of Upper Canada, was deferred after the construction of the locks at Glen Ross, Hastings, Peterborough, Bobcaygeon, and Lindsay between the years 1833 and 1844. These locks, together with locks constructed by the Provincial Government in 1869-72 at Young's Point and Rosedale, had made available to navigation about 172 miles of lakes and rivers, divided into five unconnected reaches: Healey-

Peterborough, Lakefield-Burleigh, Buckhorn-Fenelon, Fenelon-Coboconk, Lakes Simcoe and Couchiching, and also Sturgeon Lake to Port Perry.

In 1883-87 locks and short canals were built by the Dominion Government at Burleigh, Lovesick, Buckhorn, and Fenelon, connecting the Kawartha lakes. By the construction of the Peterborough-Lakefield and Balsam-Simcoe Divisions, 1895-1907, 167 miles of the through route were made available, which, with the Scugog navigation, opened over 200 miles of inland navigation without outlet to the Great Lakes. Outlet to Lake Ontario was given on the opening of the Ontario-Rice Lake Division in June, 1918. By the opening of the lock at Washago, on the 6th July, 1920, and the construction of the Marine Railways at Swift Rapids and Big Chute, motor vessels up to 56 feet in length can now sail from Lake Ontario into Lake Huron through the lock at Port Severn connecting Gloucester pool with Georgian Bay, which lock was opened in July, 1915. The first vessel to make the through trip was the motor launch *Irene*. She left Trenton on the 3rd July, 1920, and arrived at Port Severn on the 12th July, 1920.

Locks.

The works by which the Trent navigation has been improved to date may be summarized as follows: Trenton to Lake Simcoe, forty-two locks; between Trenton and Frankford, six locks; Glen Ross, one; between Glen Ross and Campbellford, five locks, including two locks in flight at Ranney Falls; between Campbellford and Crow Bay, two locks; at Healey Falls, three, including two in flight; Hastings, one;

Peterborough, one; Peterborough to Lakefield, seven locks, one being the largest hydraulic lift in operation; one at Young's Point; two in flight at Burleigh Falls; one at Lovesick, Buckhorn, Bobcaygeon; two in flight at Fenelon Falls; one at Rosedale; and six locks between Balsam and Simcoe Lakes, one being an hydraulic lift; also lock and dam at Lindsay.

DAMS.

Maintaining and regulating the levels in the various reaches connected by these locks are forty-two stoplog dams and two bench dams, as follows: seven between Trenton and Frankford; one at Glen Ross; five between Glen Ross and Campbellford; two between Campbellford and Crow Bay; one at Healey Falls, Hastings, and Peterborough; Peterborough to Lakefield, seven; one at Young's Point; two at Burleigh; five at Lovesick; one at Buckhorn; two at Bobcaygeon; one at Fenelon Falls; one at Rosedale; and five between Balsam and Simcoe Lakes; also one at Gilchrist Bay, Stoney Lake.

SEVERN DIVISION.

Between Lake Couchiching and Lake Huron, locks now in operation are located at Washago and Port Severn. Locks partly built are situated at Swift Rapids, Big Chute, and Little Chute. Marine railways at Swift Rapids and Big Chute now carry motor-boats from reach to reach at these points. Fifteen stoplogs, two fixed and seven impounding dams now maintain canal levels on the various reaches.

BRIDGES.

In all fifty-three bridges cross the route of the canal system from Trenton to Lake Simcoe, in addition to which two swing bridges carrying railway traffic and one carrying highway traffic cross Atherley narrows between Lake Simcoe and Couchiching. Nineteen of these carry railway traffic, of which seven are high-level fixed spans, eleven swing spans, and one bascule. Of the thirty-seven bridges carrying highway traffic, three are high-level fixed spans, one high-level concrete arch, two bascule, one floating bridge, and thirty swing spans.

On the Severn Division, three bridges—two high-level and one swing span—carry railway traffic, and four—three swing spans and one high-level—carry highway traffic.

WHARVES.

Sixty-five public service wharves are maintained by the department on Trent and Severn waters, of which thirty-nine are wooden structures, the remainder being concrete.

AIDS TO NAVIGATION.

Thirty-four lighthouses and about seven hundred buoys are maintained as aids to navigation.

RESERVOIR SYSTEM.

Stream flow and navigation levels are maintained by a system of reservoirs in Haliburton and the northern part of Peterborough counties. Sixty-five lakes are used to retain

the run-off until needed. Forty-eight dams store the water on these lakes, of which fourteen are of concrete construction and thirty-four of cribwork. Sixteen other cribwork dams have to be maintained for log flotation.

SIZE OF VESSELS

In its present state different divisions of the canal will accommodate different sizes of vessels. The limit of size of vessel which may use the several divisions is as follows:—

LAKE ONTARIO TO PETERBOROUGH.

The dimensions of the largest vessel which can be accommodated on this division are 154 feet long, if full canal width of 32 feet. If the vessel is of lesser width, a greater length can be accommodated, the extreme being 162 feet, provided vessel is not wider than 21 feet.

Square-built scows of 32 feet beam to a length of 145 feet can be accommodated. Square-built scows of 21 feet beam or less, to a length of 154 feet, can be accommodated.

The available depth on this division of the canal is 8 feet.

Vessels of full O.R.L. size, but confined to 8 feet draught, can now reach Lock 19 at the city of Peterborough.

PETERBOROUGH TO LAKE SIMCOE.

The largest vessel which can reach Lake Simcoe from Lake Ontario is one of 117 feet in length if it does not exceed 22 feet in width.

Square-built scows of a width of 31 feet or less can be accommodated to a length of 104 feet.

The available depth is 6 feet and the minimum clearance under high-level bridges is 23 feet 6 inches.

LAKE SIMCOE TO GEORGIAN BAY.

The largest motor-boat of usual design which can make the trip from Lake Simcoe to Georgian Bay by being taken over marine railways at Swift Rapids and Big Chute is one of 56 feet in length by 13.5 feet beam and about 4 feet draught. The weight of such vessels should not exceed 5 tons.

DESCRIPTION OF THE VARIOUS DIVISIONS OF THE CANAL ONTARIO-RICE LAKE DIVISION

This division extends from the town of Trenton, on the Bay of Quinte, Lake Ontario, to Rice Lake, a distance of 57 miles following the course of the Trent River and is all river navigation with the exception of 9 miles of canal prism.

The river route from Lake Ontario to Rice Lake was adopted in 1907, in which year construction work was started. It was officially opened to navigation in 1918.

The improvement consists of fourteen concrete stoplog dams built across the river at suitable points, which maintain the several pools thus created at the desired levels. These pools are connected by locks and short sections of canal. Three other dams or concrete weirs were provided, two of which make available for development 15,000 horse-power.

There are in all eighteen locks on the division, overcoming a total rise from Lake Ontario to Rice Lake of 369 feet 6

inches with Lake Ontario at minimum level. At Locks 11–12 two lock chambers in flight overcome a difference in level of 48 feet, while at Locks 16–17 two locks in flight overcome a lift of 54 feet, which is the maximum lift at any lock on this division. Lock No. 3 also has a lift of 27 feet. The minimum lift is 9 feet at Lock No. 18. All locks are built of concrete and are 175 feet in length, 33 feet in width, with 8 feet 4 inches of water over the sills at normal levels. They are filled through culverts in the walls with laterals extending into the chambers, which gives very little agitation in the chambers when filling. These locks will accommodate barges of 800 tons carrying capacity whose size may be 154 feet long by 32 feet beam and 8 feet draught. Entrance piers of not less than 150 feet in length are provided at all locks.

In the canal and river reaches the minimum depth is 9 feet. In canal reaches the bottom width of prism is 80 feet except in two cases of short canals where the bottom width is 50 feet only. In the river reaches the minimum width of excavated channel is 100 feet. About 34 miles of open river navigation has an average width of 500 feet. All channels are adequately buoyed.

Seventeen bridges cross the route of the canal, ten of which carry highway traffic and seven railway traffic. Of the highway bridges nine are swing and one a bascule span. Three railway bridges are swing and one a bascule span. Three railway bridges are high-level fixed spans having a minimum clearance above water of 29 feet.

Emergency dams consisting of small deck girder swing-bridges, of unequal arms, carrying cars and winches for

handling steel stoplogs, are provided at Locks Nos. 6, 7, 12, 14, 17, and 18.

Through the town of Campbellford about one mile of concrete retaining wall encloses the river.

Power-houses, using heads made available by navigation dams, have been constructed at Locks Nos. 2, 5, 13, 14, and 17, and another is being built at Lock 12.

RICE LAKE TO PETERBOROUGH

From the foot of Rice Lake to the mouth of the Otonabee River, 12 miles, the natural channels are ample for vessels of O.R.L. size. On the line of the old Cobourg and Chemung Railway across the lake, four openings have been provided and supplied with buoys.

Three channels give access from Rice Lake to the Otonabee River, the center one being provided for deeper navigation.

From Rice Lake to Lock No. 19, situated on the outskirts of the city of Peterborough, 89 miles from Trenton, the Otonabee River is being deepened to accommodate vessels of full O.R.L. size. At present the maximum depth is 7 feet; however, vessels of 8 feet draught will be able to reach Peterborough during the coming season. All channels are being widened to 100 feet and deepened to 9 feet. Two highway bridges cross the Otonabee River at Bensfort and Wallace Point.

Lock No. 19 is a masonry structure originally built in 1837-44 and deepened in 1904. It is but 134 feet between hollow quoins and will only accommodate vessels of 121 feet by 32 feet by 8 feet, or 126 feet by 22 feet by 8 feet.

From Lock No. 19 the channel enters Little Lake in the city of Peterborough, the level of which is maintained by a concrete dam at Lock 19.

Two bridges, one highway swing and one railway swing, cross the river immediately above Lock No. 19.

PETERBOROUGH-LAKEFIELD DIVISION

This division embraces four miles of artificial waterway from Little Lake to Nassau and six miles of canalized river to Lakefield. Construction was completed and the division opened to 6-ft. navigation in 1904. The rise from Peterborough to Katchawano Lake above Lakefield is 141 feet.

The maximum size of vessel which can be accommodated is 125 feet long, 32 feet beam by 6 feet draught. The clearance under high-level bridges is 24 feet 6 inches only.

Leaving Little Lake through Lock No. 20, in a distance of about half a mile, the Peterborough hydraulic lift lock is reached, where there is a lift of 65 feet into a reach which extends to Lock No. 22, about five miles from Peterborough; the last mile only of this reach is in the natural river, the level of which is maintained by the Nassau dam; from here to Lakefield concrete Locks 22, 23, 24, and 25, with their respective cribwork stoplog dams, give navigation to Lakefield, about 10 miles from Peterborough, or 99 from Trenton.

At Lakefield a concrete stoplog dam, completed in 1921, regulates the level of Katchawano Lake. Lock No. 26, with 16 feet lift and a half mile of canal, completes this division by giving access to the first of the Kawartha lakes—Katchawano.

Another stoplog dam located about two miles above Peterborough is used for unwatering the canal reach between Peterborough and Nassau.

Five highway bridges, two of which are high-level fixed spans and two railway swing spans, cross the canal on this division.

Four submerged guard gates protect the canal, one at Norwood Road bridge, one at Warsaw Road bridge, one at Nassau, and one above Lock 26 at Lakefield.

PETERBOROUGH HYDRAULIC LIFT-LOCK

Size of chambers—Length, 139 feet.

Width, 33 feet.

Height of plating, 9 feet 10 inches.

Weight of water in chamber, 1,140 tons.

Metal work, 1,400 tons.

Lift, 65 feet.

Diameter of presswells, 7 feet 8½ inches.

Diameter of rams, 7 feet 6 inches.

Concrete, 26,000 cubic yards.

Height of towers from rock, 100 feet.

Will accommodate vessels of 6 feet draught.

The hydraulic lock is theoretically an automatic machine and is designed to take the place of ordinary locks where a great difference of level is found in a short distance.

In principle the hydraulic lock may be likened to two immense hydraulic elevators of the simple plunger type, having their presses connected together so that the descent of the one causes the rise of the other. In place of the ordinary

elevator platform we have a large water-tight box, or tank, closed at either end by a gate.

An ordinary lockage is conducted in this manner: Suppose 100 tons of surcharge has been found to give sufficient additional weight to the descending chamber; the uppermost chamber will then be required to stop with its floor $8\frac{1}{2}$ inches lower than the bottom of the upper reach. On communication being established with the reach, it receives from the reach 100 tons more than the lower chamber contains, assuming the depth of both reaches to be the same. Then the total operations to make the lockage, if the gates adjoining the reaches are opened and the seal tubes are inflated, consists in hauling the vessel into the chamber and mooring her there securely, closing the gates, deflating the seal tubes, and opening the main valve between the presses. The heavier chamber then commences to descend, the motion being allowed to increase gradually by the gradual opening of the valve until it reaches the maximum speed. At about three-quarters of the stroke the main valve is slowly closed, communication between the presses being entirely cut off when the end of the journey is reached. The change in elevation being made, the seal tubes are inflated, the gates are opened, and the vessel or vessels are free to go on their journey, after being towed out by the capstans. The surcharge contained in the descending chamber simply flows out into the lower reach, while a similar quantity to perform the next lockage is admitted into the chamber which has just reached the higher elevation.

The record lockage, so far, at the Peterborough lock is six and a half minutes, being the whole time from the stop-

ping of the vessel in the lower reach to her proceeding on her journey under her own steam in the upper one.

KAWARTHA LAKES

From Lakefield for 61 miles to "The Fort," on the western side of Balsam Lake, 160 miles from Trenton, the route, navigable with a depth of 6 feet, follows the Kawartha Lakes and their connecting rivers. Other channels, to the eastern end of Stoney Lake, two to Chemong Lake, Pigeon Lake to Omemee (small motor-boats only) and from Rosedale to Coboconk add in all 42 miles to the total length of channels to be maintained.

At Young's Point, a masonry lock and timber dam, together with a small dam at Gilchrist Bay, maintain navigation through Clear and Stoney Lakes to Burleigh, a distance of about nine miles.

At Burleigh, a masonry lock of two lifts, totaling 24 feet, a concrete and a wooden dam, maintain navigation through Lovesick Lake about two miles to Lovesick.

At Lovesick, a masonry lock and five timber dams maintain navigation through Deer bay for about five miles to Buckhorn.

At Buckhorn a short canal, a masonry lock and concrete dam maintain navigation for about $16\frac{1}{2}$ miles through Buckhorn and Pigeon lakes to Bobcaygeon, 136 miles from Trenton; also navigation from Buckhorn Lake through Chemong Lake to Bridgenorth, and (for small motor-boats) in the Pigeon River from Pigeon Lake to Omemee.

At Bobcaygeon, a new concrete lock of O.R.L. dimensions,

175 feet by 33 feet by 8 feet 4 inches, and two concrete dams maintain navigation through Sturgeon Lake and Fenelon River, a distance of about $14\frac{1}{2}$ miles to Fenelon Falls. A submerged guard gate protects the canal. A dry dock which will accommodate vessels of 140 feet by 30 feet by 6 feet is also provided at Bobcaygeon.

At Fenelon Falls is a short canal, a masonry lock of two lifts totaling 23 feet 6 inches, and a concrete dam, which maintain navigation across Cameron Lake to Rosedale, a distance of about $3\frac{1}{2}$ miles.

At Rosedale a concrete lock of O.R.L. dimensions protected by an emergency dam, and a concrete dam maintain navigation on Balsam Lake, the summit level of the canal, 597.40 feet above Lake Ontario.

BRIDGES.

No overhead bridges limit the height of vessels on the main channels of the Kawartha Lakes. One floating and seven swing-bridges carrying highway traffic and one swing carrying railway traffic cross the route on this section of the system.

The Lindsay Branch, which embraces Lake Scugog, a lock and dam at Lindsay, and the Scugog River from the main channel on Sturgeon Lake, in all, 37 miles to Port Perry, may also be included in this section of the system. Scugog navigation is restricted to the clearance under the Grand Trunk Railway fixed span at Lindsay, i. e., 31 feet. The Canadian Pacific Railway also crosses the Scugog River on a high-level

fixed span, while two swing spans and one bascule carry highway traffic in the town of Lindsay.

BALSAM-SIMCOE DIVISION

This division extends from Balsam Lake to Lake Simcoe, near Beaverton, 178 miles from Trenton.

By a canal 6 miles in length, having 6-foot depth and a bottom width of 50 feet, and a small lake, the summit level of Balsam Lake is carried to the Kirkfield hydraulic lift-lock, 166 miles from Trenton.

This lock is somewhat similar to the hydraulic lift at Peterborough; the chief points of difference being steel towers carrying the chamber guides instead of concrete towers as at Peterborough, direct pressure from intensifying pumps instead of the use of an accumulator, water instead of air seals, interlocking control machinery, hydraulic pumps instead of air lift for removing water from the presswells, gates operated by arm on shaft instead of sprocket chains and wheels. The lock is protected against Balsam Lake level by three submerged guard gates, one near Balsam Lake, one at the Grand Trunk Railway crossing, and one at the lift-lock. It drops vessels 49.17 feet to the reach below, which extends for about eight miles to Lock No. 37.

From Lock 37 to Lake Simcoe in five miles are five locks which lower vessels to Lake Simcoe level, 474.33 feet above Lake Ontario.

Five stoplog dams maintain and regulate navigation levels on this division.

On this division are twelve bridges. Two are high-level, one a fixed span and one concrete arch carrying highway traffic. Six swing spans carry highway traffic. Four bridges carry railway traffic, two of which are swing spans and two high-level fixed spans. The clearance under one of the latter is 23 feet 6 inches only.

SEVERN DIVISION

This division, between Lake Couchiching and Port Severn on Georgian Bay, a total distance of 32 miles, consists of 2 miles of canal, $5\frac{1}{4}$ miles of subaqueous channel and $23\frac{3}{4}$ miles of deep river and lake navigation; with a fall from Lake Couchiching to Georgian Bay of about 139.5 feet which will be overcome by five locks.

The upper end, from deep water in Lake Couchiching to the Severn River, included the construction of a lock at the outlet of the canal into the Severn River, one highway swing-bridge, one railway swing-bridge, and one highway high-level fixed span, also six control dams on the three branches of the river at Washago, all of which are completed. The excavation of the channel and canal cut across country is not yet completed but is navigable for vessels of 6-foot draught, as is also the river channel to Hamlet bridge. To accommodate vessels of the regulation size considerable dredging will be required over this channel and canal cut.

From Hamlet bridge, where a highway swing span is being constructed, to Sparrow Lake the channel is only navigable for boats of a size which can be portaged by the marine rail-

ways at Swift Rapids and Big Chute. This also applies to the remainder of the river reach from Sparrow Lake to Gloucester Pool below Little Chute. Over this portion of the route considerable work has been done, but owing to the war and other contingencies, it has not been completed.

At Swift Rapids, where the water has been raised 47 feet, by the construction of a dam, a power-house has also been constructed and placed in commission. As the lock at this point is only partly built, to overcome the lift between the two levels a marine railway carrying small boats has been placed in commission. In addition to the completion of the main dam and power-house, two earth-fill dams with concrete cores, and the Canadian National Railway high-level bridge have been constructed a short distance above the lock.

In the reach, Swift Rapids to Gloucester Pool and the various channels connected therewith, considerable work has been performed in excavating, constructing dams, etc.; and in the construction of the Canadian Pacific Railway high-level bridge at Severn Falls. In various channels connected with the Severn River and Gloucester Pool, regulating dams have been constructed on Pretty Channel, White's Portage, Lost Channel and one small regulating sluice on Six-mile Lake. In addition to the above, earth-fill dams with concrete cores are constructed on Six-mile Lake channels, Copps Bay, and at Moredolphton Club, also one timber crib dam on Hungry Bay. At Big Chute and Little Chute where locks are to be built, a considerable quantity of work has been performed, consisting mostly of rock excavation in preparation for foundations and prisms; also in the construction of core

walls, wing walls, etc. From Big Chute to the pool below Little Chute the river channel is navigable for such craft as may be portaged by the marine railway at Big Chute, which is of similar design and capacity to that at Swift Rapids.

The channel from the foot of Little Chute to Georgian Bay through the lock at Port Severn is navigable for vessels of 6-foot draught. The work at Port Severn, which consisted in the construction of a small lock, one large and two small regulating dams along with other small dams, embankments and walls, has been completed and is for the purpose of accommodating smaller vessels than those which will be accommodated with the construction of the northerly entrance at Honey Harbor.

The Honey Harbor route from Little Chute to deep water on Georgian Bay through Gloucester Pool, Go-Home Bay and Honey Harbor, on which no work has been performed, consists in the building of a lock at Honey Harbor, one fixed highway bridge and considerable excavation. This route when completed will give accommodation to vessels of the regulation size.

CHARTS

A set of eleven navigation charts of the route from Trenton to Nassau, on the Otonabee River, with an index plan, may be obtained from the Superintendent, Trent Canal, Peterborough, Ontario, on payment of the sum of \$3.50.

The following is a list of all locks, etc., now in use from Lake Ontario to Georgian Bay, giving distances, dimensions, lifts; also length of canals:—

APPENDIX

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Miles from Trenton	Lock No.	Locality	Length between H. Quoins Feet	Width Feet	Depth on Sill Feet	Lift Feet	Length of Canal Prism Miles
1.8	1	Trenton Junction	175	33	8.4	20	$\frac{3}{4}$
2.4	2	Trenton Junction	175	33	8.4	20	
3.9	3	Glen Miller	175	33	8.4	27	1
5.2	4	Glen Miller	175	33	8.4	18	
6.4	5	Frankford	175	33	8.4	18	$\frac{1}{4}$
7.3	6	Frankford	175	33	8.4	16	$1\frac{3}{4}$
13.9	7	Glen Ross	175	33	8.4	10	$\frac{1}{2}$
25.2	8	Porcy Landing ..	175	33	8.4	19.6	$1\frac{3}{4}$
26.4	9	Myersburg	175	33	8.4	16	
27.9	10	Myers Island ..	175	33	8.4	24	$\frac{3}{4}$
29.6	11	Campbellford (Flight)	175	33	8.4	48	1
	12						
32.1	13	Campbellford ...	175	33	8.4	23	$\frac{1}{2}$
33.6	14	Middle Falls ...	175	33	8.4	25	
36.1	15	Healey Falls ...	175	33	8.4	21.8	
36.5	16	Healey Falls (Flight)	175	33	8.4	54	1
	17						
51.0	18	Hastings	175	33	8.4	9	
88.3	19	Peterborough ..	134	33	8.0	8	
89.0	20	Peterborough ..	142	33	6.0	12	
89.3	21	Peterborough Hy- draulic Lift Lock	140	33	6.0	65	$3\frac{1}{2}$
93.9	22	Peterborough— Lakefield Divi- sion	142	33	6.0	14	$\frac{1}{4}$
94.4	23	Peterborough— Lakefield Divi- sion	142	33	6.0	12	
96.0	24	Peterborough— Lakefield Divi- sion	142	33	6.0	12	$\frac{1}{4}$
96.8	25	Peterborough— Lakefield Divi- sion	142	33	6.0	10	
98.3	26	Lakefield	142	33	6.0	15.7	$\frac{1}{2}$
103.3	27	Young's Point ..	133	32.6	6.0	7.3	
112.3	28	Burleigh Falls (Flight)	150	33	6.0	24	
	29		134				
114.3	30	Lovesick	134	33	6.0	3.5	
119.3	31	Buckhorn	134	33	6.0	11.5	$\frac{1}{4}$
135.8	32	Bobcaygeon	175	33	8.4	5.4	$\frac{1}{4}$
150.3	33	Fenelon Falls (Flight)	150	33	6.0	23.6	$\frac{1}{2}$
	34		134				
153.8	35	Rosedale	175	33	8.4	4	1
165.6	36	Kirkfield Hy- draulic Lift Lock	140	33	6.0	49.17	6
173.3	37	Balsam—Simcoe Division	142	33	6.0	21.5	6
174.3	38	Balsam—Simcoe Division	142	33	6.0	14	
175.8	39	Balsam—Simcoe Division	142	33	6.0	14	
176.3	40	Balsam—Simcoe Division	142	33	6.0	14	3
177.0	41	Gamebridge ...	142	33	6.0	10.5	
203.6	42	Washago	175	33	8.4	20	2
219.9		Marine Railway —Swift Rapids	35	9	3.0	47	
228.1		Marine Railway —Big Chute ..	35	9	3.0	58.1	
235.4		Port Severn ...	100	25	6.0	14.5	
154.0		Lindsay	142	33	6.0	7	
		Totals	...	..	...	867.17	$32\frac{1}{4}$

DISTANCE, WEATHER, RADIO AND GENERAL NAVIGATIONAL
DATA FOR THE GREAT LAKES AND THEIR CONNECTING
RIVERS AND CANALS

Compiled from the latest Bulletins of "SURVEY OF
NORTHERN AND NORTHWESTERN LAKES," issued by the
U. S. Lake Survey Office, Detroit, Michigan.

Table I.—DISTANCES BETWEEN POINTS ON GREAT LAKES.

	36	35	34		33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1		
Port Arthur.....																																							
Two Harbors.....																																							
Duluth.....																																							
Ashland.....																																							
Houghton.....																																							
Marquette.....																																							
Sault Ste. Marie.....																																							
Eschschau.....																																							
Green Bay.....																																							
Milwaukee.....																																							
Chicago.....																																							
Gary.....																																							
Muskegon.....																																							
Ludington.....																																							
Alpena.....																																							
Bay City.....																																							
Godenich.....																																							
Collingwood.....																																							
Midland.....																																							
Port Huron.....																																							
Detroit.....																																							
Toledo.....																																							
Lorain.....																																							
Cleveland.....																																							
Feldport.....																																							
Ashabula.....																																							
Conneaut.....																																							
Erie.....																																							
Buffalo.....																																							
Port Colborne.....																																							
Charlotte.....																																							
Oswego.....																																							
Toronto.....																																							
Kingsburg.....																																							
Ogdensburg.....																																							
Montreal.....																																							

Thus, measured distances to the two points from 0.8 mile: if the respective distances to the two points from a certain port measure 118.0 and 115.2, they appear in the table as 116 and 115, a difference of 1 mile; whereas from the next port listed, the distances to the same two points may measure 106.4 and 104.6, and both will appear in the table as 105.

Measurements are by the shortest marked or safe direct course, starting (unless otherwise noted) from the main entrances between pierheads of breakwaters or piers, or from the principal landings of open roadsteads. Where landings are appreciably remote from protected entrances, the appropriate further distances, if desired, may be ascertained from the harbor descriptions or from charts.

Points in this table are arranged in the order of their location on the several lakes in the following sequence: Lake Superior, Lake Michigan, Lake Huron, Lake Erie, Lake Ontario, Lake St. Clair, Lake St. George, Lake Champlain, Lake George, Lake Champlain, Lake Ontario, Lake Erie, Lake Michigan, Lake Huron, Lake Superior.

EXPLANATION.

EXPLANATION.

Distances in these tables are expressed to the nearest even statute mile; fractions of 1 mile or more being taken as a full mile and those under the half dropped. The results are, therefore, at times inconsistent by 1 mile.

Points in this table are arranged in the order of their location on the several lakes in the following sequence: Lake Superior, Lake Michigan, Lake Huron, Lake Erie, and Lake Ontario.

The distance between any two points appears in the line extending horizontally from the point first in order in the list and in the column headed by the other point.

Measurements are by the shortest marked or safe direct course, starting (unless otherwise noted) from the main entrances between pierheads of breakwaters or piers, or from the principal landings of open roadsteads. Where landings are appreciably remote from protected entrances, the appropriate further distances, if desired, may be ascertained from the harbor descriptions or from charts.

From abreast east end of U. S. center pier.
From Fort Gratiot range.

Other tables to which initial points Nos. 1-4 are common:
 III—Lake Michigan.
 IV—Lake Huron and St. Marys River.
 V—Lake Erie, St. Clair, Detroit, and Niagara Rivers.
 VI—Lake Ontario and St. Lawrence River.

- ^a From Fort Gratiot range.
- ^b From sailing course point north of light.
- ^c From abreast east end of U, S. center pier.
- ^d Via Keweenaw Waterway.

Table IV.—DISTANCES BETWEEN POINTS ON LAKE HURON AND ST. MARYS RIVER.

Other tables to which initial points Nos. 1-3 are common: 11—Lake Superior. 12—Lake Michigan. 13—Lake Huron. 14—St. Clair, Detroit, and Windsor Rivers. 15—St. Marys River. 16—Lake Ontario and St. Lawrence River.																																				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544	545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575	576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600	601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620	621	622	623	624	625	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649	650	651	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672	673	674	675	676	677	678	679	680	681	682	683	684	685	686	687	688	689	690	691	692	693	694	695	696	697	698	699	700	701	702	703	704	705	706	707	708	709	710	711	712	713	714	715	716	717	718	719	720	721	722	723	724	725	726	727	728	729	730	731	732	733	734	735	736	737	738	739	740	741	742	743	744	745	746	747	748	749	750	751	752	753	754	755	756	757	758	759	760	761	762	763	764	765	766	767	768	769	770	771	772	773	774	775	776	777	778	779	780	781	782	783	784	785	786	787	788	789	790	791	792	793	794	795	796	797	798	799	800	801	802	803	804	805	806	807	808	809	810	811	812	813	814	815	816	817	818	819	820	821	822	823	824	825	826	827	828	829	830	831	832	833	834	835	836	837	838	839	840	841	842	843	844	845	846	847	848	849	850	851	852	853	854	855	856	857	858	859	860	861	862	863	864	865	866	867	868	869	870	871	872	873	874	875	876	877	878	879	880	881	882	883	884	885	886	887	888	889	890	891	892	893	894	895	896	897	898	899	900	901	902	903	904	905	906	907	908	909	910	911	912	913	914	915	916	917	918	919	920	921	922	923	924	925	926	927	928	929	930	931	932	933	934	935	936	937	938	939	940	941	942	943	944	945	946	947	948	949	950	951	952	953	954	955	956	957	958	959	960	961	962	963	964	965	966	967	968	969	970	971	972	973	974	975	976	977	978	979	980	981	982	983	984	985	986	987	988	989	990	991	992	993	994	995	996	997	998	999	1000
Port Huron (V-M) ^a	228	128	120	106	98	89	80	71	62	53	44	35	26	17	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0																																																																																																																																																																																																																																																																																																																																																																																																																		

Table V.—DISTANCES BETWEEN POINTS ON LAKE ERIE AND ST. CLAIR, DETROIT, AND NIAGARA RIVERS.

Other tables to which initial points Nos. 1-3 are common: II—Late Michigan. III—Late Michigan. IV—Late Ontario and St. Mary River. VI—Late Ontario and St. Lawrence River.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
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Old Mackinac Point (III) °	Port Colborne (VI) °	Port Huron (IV) °	St. Clair	Marine City	Algoma	St. Clair	St. Clair Flats	St. Clair Flats	St. Clair Flats	St. Clair Flats	St. Clair Flats	St. Clair Flats	St. Clair Flats	St. Clair Flats	St. Clair Flats	St. Clair Flats	St. Clair Flats	St. Clair Flats	St. Clair Flats	St. Clair Flats	St. Clair Flats	St. Clair Flats	St. Clair Flats	St. Clair Flats	St. Clair Flats	St. Clair Flats	St. Clair Flats	St. Clair Flats	St. Clair Flats	St. Clair Flats	St. Clair Flats	St. Clair Flats	St. Clair Flats	St. Clair Flats	St. Clair Flats	St. Clair Flats	St. Clair Flats	St. Clair Flats	St. Clair Flats	St. Clair Flats	St. Clair Flats	St. Clair Flats	St. Clair Flats	St. Clair Flats	St. Clair Flats	St. Clair Flats	St. Clair Flats	St. Clair Flats	St. Clair Flats	St. Clair Flats	St. Clair Flats	St. Clair Flats	St. Clair Flats	St. Clair Flats	St. Clair Flats	St. Clair Flats	St. Clair Flats	St. Clair Flats	St. Clair Flats	St. Clair Flats	St. Clair Flats	St. Clair 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Other tables to which initial points Nos. 1-3 are common:

- II—Lake Superior.
- III—Lake Michigan.
- IV—Lake Huron and St. Marys River.
- V—Lake Erie, St. Clair, Detroit, and Niagara Rivers.

Points in this table are arranged in geographical sequence proceeding westward along the south shore and returning eastward along the north shore of the lake and down St. Lawrence River.

For determining distances to points located in other lakes, distances from all places listed in this table are given to the initial points Nos. 1 to 3, which also appear in the other tables respectively indicated by numeral designation. The through distance from a given point in this table to a given point in any other table is the sum of the respective distances to each given point from the initial point, which is common to the two tables. Thus Port Colborne being the common point for determining distances from Lake Ontario and St. Lawrence River to points in Lake Superior (Table II), a through distance would be derived as follows:

Port Colborne to Cornwall.....	297
Port Colborne to Port William.....	648
Cornwall to Port William.....	1,145

Explanation generally applicable to all tables is published in Table I.

From Fort Gratiot range.

c From upper end of canal.

SECRET

LAKE SUPERIOR

The depths herein given are referred to low-water datum, the reference plane for U. S. river and harbor improvements, which for Lake Superior is an elevation 601.6 feet above mean sea level. Depths on the Lake Survey charts, referred to standard low water, are 1 foot less than those herein published.

DIMENSIONS, SURFACE ELEVATIONS, ETC.

[All elevations are expressed in terms of the adjusted levels of 1903.]

Length, steamer track, Duluth Canal to

Point Iroquois (approximate) miles 383

Length (right line in clear), Duluth

Canal to Michipicoten Harbor miles 350

Breadth, about longitude $86^{\circ} 45'$ miles 160

Areas in square miles:	United States	Canada	Total
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Water surface of lake *	... 20,710	11,100	31,810
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Entire drainage basin *	... 37,420	43,280	80,700
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Depth, maximum recorded by Lake Survey..feet.. 1,180

Rainfall, average annual.....inches.. 28

High water of 1838, above mean sea level....feet.. 605.32

Standard low water (adopted for charts),

above mean sea level.....feet.. 600.50

Mean surface, 63 years, 1860-1922, above

mean sea level.....feet.. 602.28

Mean surface above mean surface of Lake

Huronfeet.. 21.16

* Including St. Marys River above St. Marys Falls.

Season of navigation, average dates:	Opening	Closing
Duluth, Minn	Apr. 21	Dec. 14
Keweenaw Waterway, Mich.	Apr. 22	Dec. 8
St. Marys Falls Canals, Mich.	Apr. 25	Dec. 7

GENERAL DESCRIPTION

Lake Superior is the largest of the Great Lakes, and also one of the largest expanses of fresh water on the globe. It is characterized by deep water and by high and rocky shores along a large portion of its coast. Compared with the other Great Lakes, its surface is more elevated above the sea, it is more irregular in outline, has deeper and colder water, more fog, more ice, a shorter season of navigation, less rain, about the same snowfall, and winds and seas not greatly different.

Fluctuations of Water Level.—The average or normal elevation of the lake surface varies irregularly from year to year. During the course of each year the normal level is subject to a consistent seasonal rise and fall, reaching its lowest stage usually at about the close of winter and attaining its highest stage during the late summer. In the last five years, the highest annual stages (taking the maximum monthly mean height of each year) have ranged from 0.92 to 1.27 feet above low-water datum, and the lowest annual stages (taking the minimum monthly mean height of each year) have ranged from 0.37 foot below to 0.39 foot above low-water datum, to which depths are referred in the descriptions following. In the 63 years from 1860 to 1922, the difference between the highest (604.08) and the lowest

(600.53) monthly mean stages of the whole period was 3.55 feet; the greatest annual fluctuation as shown by the highest and the lowest monthly means of any year was 2.67 feet, and the least annual fluctuation was 0.53 foot.

Through joint action on the part of the United States and Canada, the fluctuation of Lake Superior is being regulated by compensating works located in the St. Marys River at the head of St. Marys Falls, which consist of dikes and sluice gates so operated as to vary the volume of discharge from the lake. The purpose of this regulation is to neutralize the changes in flow consequent upon diversions of water around the rapids for power development, and to limit the fluctuation of the lake surface within an ordinary range of 1.5 feet, between the elevations of 0.5 foot and 2 feet above low-water datum, and within a maximum range between the elevations of low-water datum and 2.5 feet above low-water datum.

In addition to the annual fluctuation, there are occasional oscillations of irregular amount and duration. Sometimes these are apparently seiches, resulting from variations in barometric pressure, which may produce changes ranging from a few inches to several feet, and return to the normal, within a few hours. At other times the level is affected by winds of sufficient velocity to drive the surface water forward in greater volume than that carried by the lower return currents, thus raising the elevation on the lee shore and lowering it on the weather shore. These wind-produced changes may range in amount up to about 2 feet, dependent upon the violence of the storms which occasion them, but seldom exceed 1 foot above or below normal level, and their duration is

governed by the sustained force of the winds. The unusually severe storm of November 28, 1905, temporarily raised the water level in Duluth Harbor to 2.3 feet above the normal or unaffected stage of the lake at the time.

Storms.—The prevailing storms are from the northeast and northwest. The natural route of United States commerce near the southern side lies, therefore, throughout its whole extent along a lee shore. During storms the water rises less on the lee shore and falls less on the weather shore than it does on the shoaler lakes, as the greater depth of water allows the lower return currents to flow more freely. During the summer months the perils of navigation are mainly those of fog and squall winds, the latter occurring almost invariably in connection with thunderstorms. In the spring and fall the lake is stormy and dangerous. The maximum observed wind velocities are as follows, according to reports received from the United States Weather Bureau stations located at Duluth, Marquette, and Sault Ste. Marie:

	Duluth			Marquette			Sault Ste. Marie		
	Year.	Direc- tion.	Miles per hour.	Year.	Direc- tion.	Miles per hour.	Year.	Direc- tion.	Miles per hour.
April ...	1912	NW.	70	1891	W.	49	1893	SE.	60
May	1916	W.	64	1918	S.	52	1916	W.	53
June	1904	NE.	63	1918	SW.	56	1918	NW.	50
July	1907	NW.	56	1901	SW.	68	1911	NW.	48
August ..	1917	NW.	56	1890	SW.	48	1897	NW.	50
September	1881	NE.	78	1893	S.	61	1904	NW.	56
October ..	1918	W.	65	1921	W.	51	1893	NW.	50
November	1905	NW.	70	1894	SW.	48	1896	NW.	52
December	1922	NW.	67	1876	W.	54	1901	NW.	54

Fog.—The area of greatest frequency of fog, according to the reports of the United States Weather Bureau, is east

of Keweenaw Point and northward of Au Sable Point, a district almost coincident with that of lowest water temperatures. Less fog is reported on the coast from Au Sable Point to Marquette and Portage Entry and the Weather Bureau regards the Keweenaw Waterway as a more acceptable route for upbound boats during the months of June, July, and August, since there will be much less liability to loss of life and property by following this line than for all vessels to lay their courses, both up and down, around Keweenaw Point.

Improved Harbors.—Compared with others of the Great Lakes, Lake Superior was fairly well provided with natural harbors, and works of improvement have created additional harbors of refuge at various points. One class of improved harbors consists of bays of generally deep water, having wide mouths or openings toward the lake, which have been provided with breakwaters to close partially the natural openings and form the desired protection. Such harbors are Marquette, Mich., Presque Isle, Mich., Two Harbors, Minn., and Grand Marais, Minn. In this connection may be mentioned Keweenaw upper entrance and Superior Entry, where breakwaters have been built, forming protected basins which are entirely artificial. Chequamegon Bay, on which the harbor of Ashland is situated, is protected from lake storms, but has so large an area that breakwaters have been built for protection against waves generated within the bay. The first general type of breakwater construction consisted of timber cribs filled with rock ballast and resting upon an embankment of riprap. At Marquette the timber-crib

super-structure of the old breakwater has been replaced by concrete, and an extension of rock rubble mound built. The rubble-mound type has been adopted at Ashland and Superior Entry. The greatest depth in which these breakwaters have been built on Lake Superior is 56 feet, at Two Harbors, Minn.

A second class of improved harbors consists of those whose entrances are formed by parallel piers or jetties extending from the shore out across a bar of gravel or sand to the desired depth of water, the primary object being either to confine the currents to a fixed and narrow width in order to scour and maintain the channel to the depth needed, or to prevent an improved channel from being filled by drifting sand. Such harbors are Duluth, Minn., Port Wing, Wis., Ontonagon, Mich., and Grand Marais, Mich. Portage Entry in Keweenaw Bay affords an illustration of a dredged channel protected from waves and drifting material by a single breakwater pier. In later years deeper channels have been required than could be obtained by the scouring action of the currents alone, and dredging has been resorted to. In the harbors at the mouths of rivers the enlargement of the channels by dredging has reduced the velocity of the outgoing currents and changed their action from that of scouring to that of depositing silt or coarser material, so that further dredging from time to time has become necessary. Therefore, the jetty piers now serve only to protect the improved channels from the filling up which would result from the action of storm waves and the so-called littoral currents.

ST. MARYS RIVER

The depths herein given for upper St. Marys River above the locks are referred to the sloping river surface corresponding to Lake Superior project plane of low-water datum, 601.6 feet above mean sea level; and for lower St. Marys River, to the sloping surface corresponding to project low-water datum elevations above mean sea level of 580.6 feet at the foot of the locks and 579.6 feet in Lake Huron. Depths on the Lake Survey charts, referred to standard low water, are 1 foot less than those herein published.

GENERAL DESCRIPTION

The St. Marys River forms the outlet of Lake Superior, connecting it with Lake Huron. From Whitefish Bay, at Point Iroquois and Gros Cap, the river flows in a general southeast direction to Lake Huron at Detour, a distance of from 63 to 75 miles, according to the route traversed.

Charts.—The United States Lake Survey charts of St. Marys River are issued in three sheets, showing the navigable conditions of the waterway, the location of all aids to navigation, and details of shore topography from Point Iroquois, Mich., and Gros Cap, Ont., at the extreme easterly end of Lake Superior, to the Detour entrance at the head of Lake Huron.

Navigation Routes—Dimensions of Channels.—From Point Iroquois to the canals, a distance of 14 miles, there are six vessel courses, and the channel has a least width of 800 feet (abreast of Point aux Pins Light), with a least depth of

23 feet, except at Vidal Shoals, where improved to a clear depth of 22 feet. Navigation around the rapids at Sault Ste. Marie is provided for by canals and locks on both the United States side and the Canadian side. Between the canals and Light No. 27 at the upper end of the Little Rapids cut into Hay Lake, the channel has a minimum width of 1,000 feet and a limiting depth of 21 feet.

At the head of Sugar Island, about 2 miles below the canal locks at Sault Ste. Marie, the channel divides. The old line of travel, known as the Lake George route, passes to the northward and eastward of Sugar Island through Lake George and East Neebish, while the other line, known as the Hay Lake route, passes to the west of Sugar Island, through Hay Lake. Between Hay Lake and Mud Lake two channels have been provided, passing on either side of Neebish Island. The West Neebish Channel, opened in 1908, passes on the west side of the island and is for the use of downbound traffic. The upbound channel (formerly used both ways) leads from the head of Mud Lake to eastward and northward of Neebish Island, traversing the Sailors Encampment Channel, Little Mud Lake, the Middle Neebish Channel, and the cut through the shallow area in lower Hay Lake. The East Neebish Channel of the Lake George route connects with this upbound channel at the head of Little Mud Lake.

The various river channels are treated in more extended detail under the head of "Local Descriptions," below.

The distance from Point Iroquois to Detour by the Hay Lake route is 63 miles and by the Lake George route 75 miles. The least width of channel by way of Hay Lake is 300 feet; the general width is 600 feet or more, and the

least depth is 21 feet. The least width of channel by way of Lake George is 150 feet and the least depth about 13 feet. The Hay Lake route, being comparatively straight in its reaches, can be navigated with reasonable safety at night, but this is not the case with the crooked Lake George route, especially as this route is not lighted. The Lake George route is marked by buoys and day mid-channel ranges and the Hay Lake route is well defined by numerous lights and buoys, the details of which are given in the printed lists issued by the United States Bureau of Lighthouses.

There is another important channel, known as the St. Joseph Channel, with least depth of about 13 feet, which leaves the Lake George Channel near its connection with the Middle Neebish Channel, at the south end of Sugar Island, and passing northward and eastward of St. Joseph Island leads into North Channel, and thence to Georgian Bay by way of Clapperton Main Passage and Little Current, or directly into Lake Huron through channels on the east and west sides of Cockburn Island, called, respectively, Mississagi Strait and False Detour Channel. These channels are all in Canadian waters.

Fluctuations of Water Surface.—Each year the St. Marys River rises and falls about 1 foot as measured by the monthly mean levels. In the past 63 years the difference between the highest and the lowest monthly mean levels above the locks has been about $3\frac{1}{2}$ feet and below the locks about 5 feet. From day to day the level fluctuates somewhat, due to wind and barometric pressure, such changes frequently amounting to several inches and sometimes to a foot or more. In addition to these changes in level, occasionally a considerable oscil-

lation takes place within two or three hours, which is somewhat in the nature of a seiche; such changes amounting to over 5 feet have been known to occur within three hours. As much of the present sailing route in the St. Marys River has been made navigable by dredging, the changes in level have a direct effect on the available draft.

SEASON OF NAVIGATION AT ST. MARYS FALLS CANALS

	Opening	Closing
Average dates since 1855.....	Apr. 25	Dec. 7
Average dates during last 20 years....	Apr. 16	Dec. 19
Dates, 1922:		
United States Canals.....	Apr. 17	Dec. 20
Canadian Canal.....	Apr. 17	Dec. 24

ST. MARYS RIVER

Schedule of Distances and Times

	Distance in statute miles	Minimum time in minutes at speed permissible	Maximum time al- lowed ves- sels towing more than one barge
UPBOUND COURSES			
Everens Point to lookout station No. 1	1.2	6	14
Lookout station No. 1 to Dark Hole turn	1.3	7	16
Dark Hole turn to Harwood Point	3.3	17	40
Harwood Point to lower north light No. 2	1.5	8	18
Lower north light No. 2 to look- out station No. 2	1.1	7	14

	Distance in statute miles	Minimum time in minutes at speed permissible	Maximum time al- lowed ves- sels towing more than one barge
Lookout station No. 2 to junction light No. 8	0.7	4	8
Junction light No. 8 to gas buoys Nos. 10 and 11	2.8	14	34
Six Mile Point near light No. 20 to Frechette Point front light No. 21	1.5	8	18
Frechette Point front light No. 21 to lower west light No. 23	1.5	8	18
Lower west light No. 23 to look- out station No. 3	0.9	5	10
Lookout station No. 3 to north entrance light No. 27	0.6	4	8
North entrance light No. 27 to east end of Brady Pier	1.6	8	20
South pier west end light to Big Point	2.3	12	28
Big Point to lookout station No. 6	2.3	12	28
Lookout station No. 6 to Point aux Pins Light	0.8	4	10
Point aux Pins Light to inter- section of Birch Point and Cedar Point ranges	4.2	21	50
DOWNBOUND COURSES			
Intersection of Birch Point and Cedar Point ranges to Point aux Pins Light	4.2	21	50
Point aux Pins Light to lookout station No. 6	0.8	4	10
Lookout station No. 6 to Big Point	2.3	12	28

	Distance in statute miles	Minimum time in minutes at speed permissible	Maximum time al- lowed ves- sels towing more than one barge
Big Point to south pier west end light	2.3	12	28
East end of Brady Pier to north entrance light No. 27	1.6	8	20
North entrance light No. 27 to lookout station No. 3*	0.6	4	8
Lookout station No. 3 to lower west light No. 23*	0.9	5	10
Lower west light No. 23 to Frech- ette Point front light No. 21*	1.5	8	18
Frechette Point front light No. 21 to Six Mile Point rear light No. 20*	1.5	8	18
Entrance crib No. 24 to crib light No. 22	2.0	10	24
Crib light No. 22 to lookout sta- tion No. 4	4.7	24	56
Lookout station No. 4 to lower dam*	1.7	10	20
Lower dam to red gas buoy No 12	0.6	3	8
Red gas buoy No 12 to lookout station No. 5	2.8	14	34
Lookout station No. 5 to lower crib No. 1	1.8	9	22

* Here expect strong current; also abreast of Sand Island.

ST. MARYS FALLS, MICH.—The rapids of the St. Marys River, located about 14 miles below the head of the river at Point Iroquois, are about $\frac{3}{4}$ mile long and $\frac{1}{2}$ mile wide,

and the fall ranges from 17 to 21 feet with the varying stages of water.

Improvement—Project.—Originally, navigation of the falls was impracticable except for logs and small craft. The State of Michigan, by means of a congressional land grant, in 1855 completed a canal 5,400 feet long and 64 feet in available width, accommodating vessels of about 11.5 feet draft, with a lock having a double lift, composed of two tandem chambers 350 feet long and 70 feet wide, with rise of 9 feet in each chamber.

In 1870 the United States entered upon the program of improvements which later provided the south canal and the Weitzel and Poe Locks. The act of March 2, 1907, provided for the construction of a third lock of enlarged dimensions and a separate canal, paralleling the old canal and locks on the north; this was completed in 1914. The act of July 25, 1912, provided for a fourth lock of the same dimensions as the third and connected with the same canal; this lock was completed in 1919.

Canals.—The distance between the eastern and western ends of the United States Canals is about 1.9 miles. The canals are faced with revetment walls and piers of timber and concrete. The width of the westerly entrance, where the two canals are in one, is 854 feet between the north and south piers, continuing for a distance of about 1,200 feet, or to the west end of the center pier which separates the south canal leading to the Weitzel and Poe Locks from the north canal leading to the Third and Fourth Locks. The total width of the easterly entrance between the Fort Brady and northeast piers is 1,260 feet.

South Canal, Poe and Weitzel Locks.—The width of the south canal between the southwest pier and west center pier is variable, being about 400 feet at the upper entrance, two passages of 108 feet each on either side of Bridge Island, 270 feet at the basin above the Weitzel and Poe Locks, and 660 feet at the lower entrance between the Fort Brady and east center piers. The depth of water in the upper level is $24\frac{1}{2}$ feet and in the lower level $19\frac{1}{2}$ feet up to the entrance to the Poe Lock. Near the east or lower end of this canal are two masonry locks, parallel and abreast of each other, and with axes 230 feet apart, known, respectively, as the Weitzel Lock and the Poe Lock.

The Weitzel Lock was opened to commerce September 1, 1881, and continued in service to October 18, 1914, when its use was temporarily discontinued. It was again in commission between June 17 and October 31, being operated from 6 A. M. to 10 P. M. This lock is 515 feet long in chamber (usable length 480 feet), 80 feet wide, narrowing to 60 feet at the gates, with low-water depth of about 13 feet; it is operated by hydraulic power.

The Poe Lock, which has been in use since August 3, 1896, is 800 feet long in chamber (usable length 677 feet to intermediate gate, 773 feet to lower gate), 100 feet wide, with a depth of 18 feet at low water. During last season the average depth was 18.3 feet. This lock is operated by hydraulic power.

Bridge Island is located in the south canal at the crossing of the International bridge. Upon this island rest the center piers of the movable dam and of the railway drawbridge. Upbound vessels passing Bridge Island will take the south

passage and downbound vessels the north passage, unless instructed to the contrary by the canal superintendent.

North Canal—Third and Fourth Locks.—The width of the north canal between the northwest pier and west center pier is 300 feet at the west end, 282 feet at the bascule bridge, 310 feet in the basin above the locks, and 520 feet in the lower entrance at the outer ends of the east center pier and northeast pier. The least depth of water in this canal, including the locks, is $24\frac{1}{2}$ feet.

The third lock, which is parallel to and 240 feet north of the Poe Lock, was opened to commerce October 21, 1914. This lock is 1,350 feet long between gates, giving a usable length of not less than 1,300 feet, 80 feet wide, and has a least depth of $24\frac{1}{2}$ feet.

The Fourth Lock parallels the Third Lock on its north side, has the same dimensions, and is connected with the same canal; it was placed in operation on September 18, 1919.

The Third and Fourth Locks are operated by electric power.

Draft of Vessels.—The depth in the north canal and Third and Fourth Locks is greater than that in the open improved channels of St. Marys River, now about 21 feet at low water. Vessels drawing 20 feet can ordinarily navigate any of these improved channels.

SAULT STE. MARIE (CANADIAN) CANAL, ONT.—This canal is a cut through red sandstone rock, 7,472 feet (about 1.4 miles) long from end to end of upper and lower piers, and its general width is 150 feet at the water surface and 141 feet 8 inches at the bottom. The approaches above and below the canal are channels dredged through boulder shoals and

marked by suitable buoys and range lights. The upper approach has a depth of $21\frac{1}{2}$ to 24 feet and, from the end of the north pier, it widens in its westerly extension to beyond the axis of the range leading from Vidal Shoals, the width being 500 feet abreast of the end of the south pier. Vessels approaching the canal from Vidal Shoals may keep on the range until past the alignment of the electric lights on the south pier, and should then turn to eastward so as to pass between the two rows of lights. The lower approach is 19 to 20 feet deep, being 230 feet wide on the southerly side of the range line, and 160 feet wide on the northerly side immediately east of the south pier; but thence southeasterly the channel widens on its northerly side so as to strike the southwest corner of the new Ontario Dock, which is 290 feet from the range line.

Lock.—A masonry lock is located near the east or lower end of the canal, 900 feet long (available length about 830 feet) by 60 feet wide, with depth on sills of about 19 feet; the lift is about 17 to 21 feet, dependent upon the stage of water; the gates and culvert valves are operated by electricity.

Bridge.—The International railway bridge crosses the canal with a draw span of about 156 feet clear width between canal walls, and 15 feet clear height above low-water surface. The draw does not sound any whistle, and the closure of the draw is indicated by an automatic semaphore. Boats should sound three long and two short whistles (—— ——— ——— —) as a request for opening the draw if it be found closed. The bridge if closed at night should show a red light.

LAKE MICHIGAN

The depths herein given are referred to low-water datum, the reference plane for U. S. river and harbor improvements, which for Lake Michigan is an elevation 579.6 feet above mean sea level. Depths on the Lake Survey charts, referred to standard low water, are 1 foot less than those herein published.

DIMENSIONS, SURFACE ELEVATIONS, ETC.

[All elevations are expressed in terms of the adjusted levels of 1903.]

Length, steamer track, Chicago to Straits of Mackinac.....miles..	321
Length (right line), from about longitude 87° 30', south end, to 85° 45', north end.....miles..	307
Breadth (right line), on about 45° 25' north latitudemiles..	118
Depth, maximum recorded by Lake Survey...feet..	870
Areas in square miles:	
Water surface of lake.....	22,400
Entire drainage basin.....	69,040
Rainfall, average annual.....inches..	32
High water of 1838, above mean sea level....feet..	584.69
Standard low water (adopted for charts), above mean sea level.....feet..	578.50
Mean surface, 63 years, 1860–1922, above mean sea level.....feet..	581.12
Mean surface below mean surface of Lake Superiorfeet..	21.16

Season of navigation, average dates:

	Opening	Closing
Straits of Mackinac.....	Apr. 12	Dec. 15

GENERAL DESCRIPTION

Fluctuations of Water Level.—The average or normal elevation of the lake surface varies irregularly from year to year. During the course of each year, the normal level is subject to a consistent seasonal rise and fall, its lowest stages prevailing during the winter months and its highest stages during the summer months. In the last five years, the highest annual stages (taking the maximum monthly mean height of each year) have ranged from 1.05 to 2.38 feet above low-water datum, and the lowest annual stages (taking the minimum monthly mean height of each year) have ranged from 0.46 foot below to 1.22 feet above low-water datum, to which depths are referred in the descriptions following. In the 63 years from 1860 to 1922, the difference between the highest (583.57) and the lowest (578.98) monthly mean stages of the whole period was 4.59 feet; the greatest annual fluctuation as shown by the highest and the lowest monthly means of any year was 2.23 feet, and the least annual fluctuation was 0.57 foot.

In addition to the annual fluctuation, there are occasional oscillations of irregular amount and duration. Sometimes these are apparently seiches, resulting from variations in barometric pressure, which may produce changes ranging from a few inches to several feet, and return to normal, within a few hours. At other times the level is affected by winds of

sufficient velocity to drive the surface water forward in greater volume than that carried by the lower return currents, thus raising the elevation on the lee shore and lowering it on the weather shore. This result is materially augmented in bays and at extremities of the lake, where the impelled water is concentrated in a restricted space by the converging shores, especially if coupled with a gradually sloping inshore bottom which reduces the depth and checks the reverse flow via lower currents. This latter condition is very pronounced at Green Bay Harbor.

East Shore—Natural Conditions and Scope of Improvements.—The east shore of Lake Michigan is generally composed of fine sand, large quantities of which are set in motion by severe on-shore winds and storms. Such harbors as existed before improvement by the United States were in the mouths of creeks or small rivers, or at the outlets of small lakes near the lake shore, and were either in their natural condition or partially improved by local enterprise. At many of them sufficient depths for large vessels existed within the shore line and in the main lake just outside, but the entrances were obstructed by extensive bars (generally close to the shore line), formed partly by the sand thrown up by storm waves or blown from the banks into the streams and carried down by the current, and partly by the sediment brought down from the upper watersheds. During the stormy seasons, when the harbors were most needed for shelter, the bars increased in height and extent, and although somewhat cut down by scour during the freshet period, they rendered the channels shifting and uncertain at all times.

It is of especial importance to navigation interests to note

that the dangerous storms of the fall, winter, and early spring are usually westerly, making entrance to the restricted harbor channels of the east shore especially difficult, and sometimes increasing dangers by the formation of storm bars.

In 1836 the United States began works of improvement at Michigan City and St. Joseph; in 1866 and 1867 operations were begun at various other harbors on the east shore, the chief object being the removal of the bars at the entrances. The invariable plan was to confine the current between parallel piers, walls, or jetties, suitably directed and a moderate distance apart, varying with the size of the stream and the needs of the harbor. Before improvement by the Government, depths at natural entrances varied from barely enough to permit the passage of small fishing boats, up to 11 feet at Muskegon and 12 feet at Grand Haven, at both of which places an increased depth had been secured by works constructed by local interests. In every case the channel was greatly improved by the Government operations, the bar being washed into deeper water; but with the extension of the piers into the lake the shore line advanced, the lake bottom was built up on both sides of the entrance by the sand set in motion by winds and currents and intercepted by the piers, and the entrance channel again shoaled, though usually not back to the original depth. This shoaling was followed by pier extensions and dredging, effecting the present channel depths, which, although invariably much greater than before improvement, are sometimes insufficient for the larger vessels of to-day. The natural processes which formed the original bars are still in operation and, as time goes on, the channels deteriorate unless dredging on a large scale is resorted to

or the piers extended. At most of the harbors the piers are now so long that repairs and maintenance make serious inroads upon available funds, and at some of them dredging is usually required each spring. Further extension of piers can in most instances afford but temporary relief at disproportionate cost; dredging is the only remedy adequate to maintain existing depths and to prevent further radical advance of the shore lines, and is proving effective.

In recent years a special type of improvement has been adopted at harbors where storm waves were wont to roll through the piers and occasion such violent disturbance as to menace or damage property and vessels inside. These conditions have been relieved by the formation in the lake of a wave-stilling basin, inclosed by breakwaters or piers which converge to an entrance opening in deep water beyond the inner piers, this basin allowing the waves to expand and lose force instead of being conducted through the confined channel between the parallel piers. Such basins now exist on this shore at Holland, Ludington, and Manistee.

Government operations in the improved harbors on the east shore have obtained channels with low-water depths of from 14 to 20 feet, varying somewhat in proportion to the volume and importance of navigation at the various ports. Harbor Springs, on the north shore of Little Traverse Bay, while limited in area, is one of the finest natural harbors of refuge on the lakes, affording security in any weather. Petoskey Harbor, on the south shore of Little Traverse Bay, is formed by a detached breakwater which shelters the wharf from westerly winds, but is of little use in heavy weather.

West and South Shores—Natural Conditions and Scope

of Improvements.—Most of the rivers flowing into Lake Michigan from the west are small and unimportant, the only large streams being the Menominee and the Fox, both of which empty into Green Bay, the most important arm of the lake. The harbors along the west and south shores are generally located at the mouths of the rivers. Before improvements were made the maximum draft did not exceed 10 or 12 feet, and as the river entrances were generally obstructed by bars, landings were made at projecting “bridge” piers which could be used only in comparatively calm weather.

The early plan of improvement consisted of two parallel piers extending into the lake and protecting a dredged channel; subsequently, at some harbors, detached breakwaters were built to provide additional protection from prevailing storms. The more recent form of entrance protection to counteract the injurious effects of wave action in inner harbors, as mentioned in the description of the east shore above, has been adopted on the west shore at Manistique, Two Rivers, Manitowoc, Sheboygan, and Racine. The outer harbors at Milwaukee, Chicago, and South Chicago (Calumet), protected by breakwaters, afford commodious and safe anchorage for all classes of vessels. The harbors of Port Washington, Waukegan, Indiana Harbor, and Gary are entirely artificial, consisting of dredged channels and basins protected by breakwaters, piers, and revetments. Sturgeon Bay, an estuary of Green Bay, is connected with Lake Michigan by a canal excavated across the narrow divide between the two, affording more direct communication between the lake and the south end of Green Bay. Escanaba, on Little Bay de Noc in the north end of Green Bay, is a good natural

harbor at which no Government work has been required. As a result of the improvements made and maintained by the United States and local interests, the harbors on the west and south shores of the lake are generally accessible to vessels drawing from 14 to 21 feet at low stages.

The rivers being generally small and draining comparatively limited areas, carry down slight quantities of material, and freshets therefore cause little silting up of the channels. While dredging for the maintenance of all the artificial channels is necessary, usually on account of sand washed in from the lake, there is marked difference in the quantity of dredging required at harbors situated only a few miles apart. The harbor of Manitowoc, Wis., is about 6 miles southwest of Two Rivers and about 26 miles north of Sheboygan. At Manitowoc dredging is necessary only once in three or four years, while it is required annually at Two Rivers and Sheboygan. Similarly, Milwaukee is about 21 miles to the north of Racine; at the latter place it is necessary to dredge annually, while at Milwaukee once in three or four years is sufficient. Both Manitowoc and Milwaukee are situated at the mouths of rivers rather larger than the average for the west shore, but both harbors are located in bays which afford protection from storms. It is the littoral drift of sand due to storms and currents, rather than material brought down by the rivers, that tends to obstruct the channel entrances. This drift extends into bays only in a small measure, but along the general shore it is more or less continuous, being greatest during storms. South of Manitowoc the drift is generally to the southward; north of Manitowoc, while not so well defined, it is generally to the northward.

The winter navigation of Lake Michigan is of importance, and regular winter lines of steamers have been operated as follows: From Chicago to Grand Haven and Muskegon; from Kenosha to Waukegan and Chicago; from Milwaukee to Racine and Chicago; from Milwaukee to Grand Haven; from Milwaukee to Muskegon; from Milwaukee to Ludington and Manistee; from Manitowoc to Ludington; from Frankfort to Manitowoc and Kewaunee; and from Frankfort to Manistique. Efforts made to maintain regular winter navigation from Frankfort to Menominee in Green Bay, via Sturgeon Bay Canal or through Porte des Morts, have not proved successful.

LAKE HURON.

The depths herein given are referred to low-water datum, the reference plane for U. S. river and harbor improvements, which for Lake Huron is an elevation 579.6 feet above mean sea level. Depths on the Lake Survey charts, referred to standard low water, are 1 foot less than those herein published.

DIMENSIONS, SURFACE ELEVATIONS, ETC.

[All elevations are expressed in terms of the adjusted levels of 1903.]

Length, steamer track, Detour Passage	
to Fort Gratiot.....miles..	223
Length, steamer track, Straits of Mackinac	
to Fort Gratiot.....miles..	247
Length (right line), Drummond Island, at	
nearest point to entrance of False	
Detour to Point Harris.....miles..	206

Breadth (right line), about $44^{\circ} 35'$ north

latitude	miles..	101	
Depth, maximum recorded by Lake Survey...	feet..	750	
Area in square miles:	United States	Canada	Total
Water surface of lake.....	9,110	13,900	23,010
Entire drainage basin.....	24,990	47,610	72,600
Rainfall, average annual.....	inches..	30	
High water of 1838, above mean sea level...	feet..	584.69	
Standard low water (adopted for charts),			
above mean sea level.....	feet..	578.50	
Mean surface, 63 years, 1860–1922,			
above mean sea level.....	feet..	581.12	
Mean surface below mean surface			
of Lake Superior.....	feet..	21.16	
Mean surface above mean surface of Lake			
Erie	feet..	8.61	
Discharge of St. Clair River at mean			
stages of Lake Huron (581.12)			
and of Lake St. Clair at St. Clair			
Flats (575.60).....	cubic feet per second..	205,000	
Increase in discharge per foot rise of lake.....			
.....	cubic feet per second..	22,800	
Season of navigation, average dates:	Opening	Closing	
Straits of Mackinac.....	Apr. 12	Dec. 15	
St. Clair River.....	Mar. 31	Dec. 19	

GENERAL DESCRIPTION

Fluctuations of Water Level.—The average of normal elevation of the lake surface varies irregularly from year to

year. During the course of each year the normal level is subject to a consistent seasonal rise and fall, its lowest stages prevailing during the winter months and its highest stages during the summer months. In the last five years the highest annual stages (taking the maximum monthly mean height of each year) have ranged from 0.88 to 2.32 feet above low-water datum, and the lowest annual stages (taking the minimum monthly mean height of each year) have ranged from 0.42 foot below to 1.12 feet above low-water datum, to which depths are referred in the descriptions following. In the 63 years from 1860 to 1922, the difference between the highest (586.66) and the lowest (579.02) monthly mean stages of the whole period was 4.64 feet, the greatest annual fluctuations as shown by the highest and the lowest monthly means of any year was 1.94 feet, and the least annual fluctuation was 0.61 foot.

In addition to the annual fluctuation there are occasional oscillations of irregular amount and duration. Sometimes these are apparently seiches, resulting from variations in barometric pressure, which may produce changes ranging from a few inches to several feet and return to normal within a few hours. At other times the level is affected by winds of sufficient velocity to drive the surface water forward in greater volume than that carried by the lower return currents, thus raising the elevation on the lee shore and lowering it on the weather shore. This result is materially augmented in bays and at extremities of the lake, where the impelled water is concentrated in a restricted space by the converging shores, especially if coupled with a gradually sloping inshore bottom which reduces the depth and checks the reverse flow

via lower currents. This latter condition is very pronounced at the mouth of Saginaw River.

On June 9, 1911, an unusual oscillation was observed in the level of the lake at the entrance to St. Clair River, evidently due to wind and barometric pressure attending severe thunder squalls passing over the lake. The level first rose about 9 inches in about an hour, followed in the ensuing two hours by a reported fall of $52\frac{1}{2}$ inches; from this low level there was a sharp return to normal within a half hour. Alternate ebb and flow of lesser extent continued at intervals of about two hours over an additional period of eight hours.

Through Navigation.—Lake Huron is a connecting link in the chain of Great Lakes, which receives the waters of Lake Michigan through the Straits of Mackinac, and those of Lake Superior by way of the St. Marys River, and discharges into the St. Clair at Fort Gratiot. The depth of water prevailing in these two rivers and at the Limekiln Crossing in the Detroit River, originally about 13 feet, has always limited the size and draft of vessels navigating Lake Huron to and from Lakes Superior and Erie.

The improvement of the Ship Channel connecting the waters of the Great Lakes between Chicago, Duluth, and Buffalo, the so-called 20 and 21 foot channel begun in 1892, has permitted the introduction of larger vessels with correspondingly increased draft, which can pass with safety and speed through Lake Huron, a distance of 223 miles between Fort Gratiot and Detour at the mouth of St. Marys River, and 247 miles between Fort Gratiot and the Straits of Mackinac.

Local Traffic—Harbors and Improved Channels.—Rockport and Calcite are the only ports along the west coast of Lake Huron with sufficient depth of water to accommodate the largest vessels for loading and unloading. Both these harbors have been created by and for interests engaged in the limestone trade, which is now of large proportions and utilizes large-type vessels for shipping purposes. Otherwise, the local traffic along the west shore is carried mostly in medium-sized vessels, lumber barges, schooners, lake tugs, and passenger boats.

Between Fort Gratiot and Pointe aux Barques there are a number of private piers or wharves, built out from the shore into deep water, where landings may be made in favorable weather. Within this reach the lake bottom is composed of rocks and bowlders, except at Harbor Beach harbor of refuge, formerly and appropriately known as Sand Beach Harbor because it was the only sandy beach found between Fort Gratiot and Saginaw Bay, and therefore afforded good anchorage for small vessels. As improved by the United States, this harbor has a sheltered area of 650 acres, in about 72 acres of which there is now an available depth of 21 feet. Heretofore it has seldom been used as a refuge by the larger vessels, which have been wont to weather violent storms in midlake.

The course across the mouth of Saginaw Bay from Pointe aux Barques to Au Sable is dangerous in heavy weather. Entering this bay, the deepest water is found between Charity Island and Point Lookout on the west shore. The water level in Saginaw Bay is subject to sudden changes due to the

wind, a northeast gale driving the water into the bay so as to raise the level at the mouth of the Saginaw River 3 to 4 feet sometimes in less than as many hours, while a southwest wind lowers the level in the entrance channel and sometimes causes deeply laden vessels to ground on the bar. Tawas Bay, affording secure anchorage in $3\frac{1}{2}$ to 4 fathoms at its head and exposed only to southwest winds, is a natural harbor of refuge for vessels which are caught by heavy weather at the entrance to Saginaw Bay.

Another natural harbor of refuge is near Alpena, in Thunder Bay, which is 78 square miles in area. This bay gives shelter in all but southeasterly gales and good holding ground is found generally under the shores. The north shore from Whitefish Point to North Point affords a good lee in heavy northeast gales in depths of 4 to 5 fathoms close to shore, with clay and sand bottom.

Going farther north, False Presque Isle Harbor, $4\frac{1}{2}$ miles northwesterly from Middle Island, affords protection for vessels from northerly and westerly winds; the area is small with fair holding ground. There are also two small harbors at Presque Isle, known as Presque Isle Harbor and North Bay, located southeast and west of Presque Isle, respectively; the former should not be entered by vessels drawing more than 12 feet. Cheboygan Harbor entrance is well sheltered, being located on the south shore of the South Channel of the Straits of Mackinac, west of McLeod Bay; the harbor itself is available for vessels drawing 16 feet.

The mouths of the few navigable streams emptying into the lake along the west shore were obstructed by sand bars which had been formed by the action of high waves and winds,

and by sediment carried down the streams during spring freshets. At Cheboygan, Alpena, and Au Sable, lumber docks were built by private parties—owners of sawmills—on both sides of a channel dredged across the bars, and these wharves have been extended from time to time, until they have become revetments for the channel improvements subsequently made by the Government.

The improvements made by the Government along the west shore of Lake Huron by dredging channels across the outer bars at the entrances to Cheboygan, Rogers, and Alpena Harbors and the Saginaw River, have been and are now of considerable benefit to the commerce of these places. The cuts were made through the sand bars and into the underlying clay and hardpan, and were of ample width so that the caving of the banks has still left the middle of the dredged channel in fair condition. In order to maintain these channels, some dredging is required from time to time.

LAKE ST. CLAIR

The depths herein given are referred to low-water datum, the reference plane for the United States river and harbor improvements, which for Lake St. Clair is an elevation 573.8 feet above mean sea level. Depths on the Lake Survey charts of St. Clair River (index No. 43), and Head of Detroit River (index No. 416), referred to standard low water, are generally $\frac{1}{2}$ foot less than those herein published; depths on chart of Lake St. Clair (index No. 42), referred to elevation 575.11, are generally $1\frac{1}{2}$ feet more.

DIMENSIONS, SURFACE ELEVATIONS, ETC.

Length, steamer track, lighthouse at southwest end of St. Clair Flats			
Canal to Windmill Point Lighthouse.	miles..	17	
Length (right line), on about longitude			
82° 45'	miles..	26	
Breadth (right line), on about latitude			
42° 25'	miles..	24	
Areas in square miles:	United States	Canada	Total
Water surface of lake *....	180	280	460
Entire drainage basin *...	2,310	4,110	6,420
Rainfall, average annual.....	inches..	34	
High water of 1838, above mean sea level...	feet..	577.86	
Standard low water (adopted for charts),			
above mean sea level.....	feet..	573.30	
Mean surface, 63 years, 1860-1922,			
above mean sea level.....	feet..	575.60	
Mean surface below mean surface of Lake			
Huron	feet..	5.52	
Mean surface above mean surface of Lake			
Erie	feet..	3.09	
Season of navigation, average dates:			
St. Clair River.....	Opening Mar. 31	Closing Dec. 19	
Detroit River.....	Mar. 30	Dec. 18	

The following list gives the monthly mean stages of the lake, above mean sea level, during the year 1922, at St. Clair Flats Canal upper entrance.

* Including St. Clair River.

January	574.05	August	575.50
February	573.40	September	575.34
March	574.17	October	574.95
April	575.26	November.....	574.54
May	575.34	December	574.26
June	575.57	Yearly mean...	574.84
July	575.65		

GENERAL DESCRIPTION

Lake St. Clair is an expansive shallow basin, having low and marshy shores and flatly sloping bottom formation, and with a maximum depth of about 23 feet. The lake has its chief importance in the ship-channel improvements which constitute a connecting link in the through waterway from Lake Huron to Lake Erie. There are no large commercial or industrial communities and no harbors of other than small local consequence located around its shores.

The ship channel for large vessels, trending northeast and southwest through the lake, has been provided by the construction of St. Clair Flats Canal and by dredging at the middle of the lake and in the Grosse Pointe Channel leading into the head of Detroit River, affording a through depth of 20 feet. The limiting width is at St. Clair Flats Canal, with 294 feet in the east or upbound channel and 300 feet in the west or downbound channel. The improved channels are subject to shoaling, which at times reduces the project widths and depth and necessitates dredging for maintenance.

DETROIT RIVER

The depths herein given are referred to the sloping surface of the river corresponding to a Lake St. Clair stage of 573.8 feet and a Lake Erie stage of 570.8 feet above mean sea level, which elevations are the project planes of low-water datum for the two lakes. Depths on the main part of Lake Survey chart of Detroit River (index No. 41), referred to Lake Erie elevation 573.11, are generally 2 feet more than those herein published; but depths on the inset of Lower Detroit River, referred to standard low water, are 1 foot less. Depths on chart Head of Detroit River (index No. 416), referred to standard low water, are $\frac{1}{2}$ foot less.

GENERAL DESCRIPTION

Physical Conditions and Current.—The Detroit River has a length of about 31 miles from its head at Windmill Point Light to Detroit River Light at its mouth in Lake Erie. Details of the waterway are shown on the Lake Survey chart of Detroit River, on which is an enlarged inset of lower Detroit River which more clearly depicts the conditions of the Amherstburg and Livingstone Channels from below the south end of Fighting Island to Lake Erie.

For the northerly or upper 13 miles, or to the head of Fighting Island, the river is of unbroken cross-section except directly at its head, where it is divided by Peach Island and Belle Isle; in the upper river the water is generally deep, the bottom is of earth, the channel banks are quite steep, and the current velocity is about $1\frac{1}{2}$ miles per hour.

The southerly or lower river broadens out and is characterized by many islands and shallow expanses; in this portion the banks are more flatly sloping than in the upper river, and the bottom consists generally of earth and bowlders with the exception of about 6 miles north of the south end of Bois Blanc Island, where the bottom is mainly bed rock and bowlders. At Limekiln Crossing, in this rock section, the mean current velocity is about 3 miles and the maximum velocity about 6 miles per hour. The limitations imposed by the natural formation of the lower river bed have necessitated very extensive rock excavation and dredging to provide channels of suitable width and depth for the large vessels engaged in lake commerce.

Channel Conditions.—From Lake St. Clair to the head of Fighting Island, a distance by steamer track of about 13 miles, the channel is 800 feet or more in width, with a minimum depth of 24 feet, the point of least width being between the shoals at the foot of Peach Island and at the head of Belle Isle. From the head of Fighting Island to the head of Ballards Reef, a distance of about 7 miles, there is a minimum depth of 22 feet and a least width of 800 feet. From Ballards Reef to deep water in Lake Erie two channels are provided, the Livingstone Channel being 22 feet deep and at least 300 feet wide, and the Amherstburg Channel being 21 feet deep and at least 600 feet wide.

Details of the various river channels are given in the "Local Descriptions" following. The channels are marked by numerous lights and buoys, as described in the printed lists issued by the U. S. Bureau of Lighthouses.

Fluctuations of Water Surface.—Each year the river

rises and falls about 2 feet as measured by the monthly mean levels. In the past 63 years the difference between the highest and the lowest monthly mean levels has been about 4 feet. During the season of 1922 the lowest mean depth for any month in the navigable channels of the river was 21.8 feet, this being in the Amherstburg Channel of the lower river. However, occasional fluctuations in depth of several feet, produced by high easterly or westerly winds, respectively raise or lower the water level at the west end of Lake Erie and similarly affect the level of the lower Detroit River; such changes have been as much as 6 feet within 8 hours.

LAKE ERIE

The depths herein given are referred to low-water datum, the reference plane for the U. S. river and harbor improvements, which for Lake Erie is an elevation 570.8 feet above mean sea level. Depths on the Lake Survey charts, referred to standard low water, are generally 1 foot less than those herein published.

DIMENSIONS, SURFACE ELEVATIONS, ETC.

[All elevations are expressed in terms of the adjusted levels of 1903.]

Length, steamer track, Detroit River

Lighthouse to Buffalo.....miles..	236
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Length (right line), clear of Point Pelee

and Long Point.....miles..	241
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Breadth (right line), Ashtabula to

Point Talbot.....miles..	57
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Depth, maximum recorded by Lake Survey..feet..	210
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APPENDIX

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Areas in square miles:	United States	Canada	Total
Water surface of lake.....	4,990	4,950	9,940
Entire drainage basin.....	23,570	11,110	34,680
Rainfall, average annual.....inches..			34
High water of 1838, above mean sea level....feet..			575.11
Standard low water (adopted for charts), above mean sea level.....feet..			570.00
Mean surface, 63 years, 1860–1922, above mean sea level.....feet..			572.51
Mean surface below mean surface of Lake Huronfeet..			8.61
Mean surface above mean surface of Lake Ontariofeet..			326.35
Discharge of Niagara River at mean stage of Lake Erie (572.51).. cubic feet per second.....			210,000
Increase in discharge per foot of rise of lake cubic feet per second.....			22,100
Season of navigation, average dates:	Opening	Closing	
Detroit River.....	Mar. 30	Dec. 18	
Toledo, Ohio.....	Mar. 28	Dec. 9	
Sandusky Bay, Ohio.....	Mar. 18	Dec. 14	
Cleveland, Ohio	Mar. 18	Dec. 18	
Buffalo, N. Y.....	Apr. 9	Dec. 12	

GENERAL DESCRIPTION

Fluctuations of Water Level.—The average or normal elevation of the lake surface varies irregularly from year to

year. During the course of each year the normal level is subject to a consistent seasonal rise and fall, its lowest stages prevailing during the winter months and its highest stages during the summer months. In the last five years the highest annual stages (taking the maximum monthly height of each year) have ranged from 1.79 to 2.97 feet above low-water datum, and the lowest annual stages (taking the minimum monthly mean height of each year) have ranged from 0.02 foot below to 1.07 feet above low-water datum, to which depths are referred in the descriptions following. In the 63 years from 1860 to 1922, the difference between the highest (574.52) and the lowest (570.63) monthly mean stages of the whole period was 3.89 feet; the greatest annual fluctuation as shown by the highest and lowest monthly means of any year was 2.49 feet, and the least annual fluctuation was 0.87 foot.

In addition to the annual fluctuation there are occasional oscillations of irregular amount and duration, produced by barometric pressure and winds. Seiches, or changes caused solely by variations of atmospheric pressure, are as a rule neither of large amount nor of sudden occurrence on this lake. However, strong winds which act to raise the elevation on the lee shore and lower it on the weather shore have a very pronounced effect on Lake Erie, because it is the shallowest of the Great Lakes and affords the least opportunity for the impelled upper water to return through reverse currents beneath the depth disturbed by storms. As a result, the water level in the harbors, particularly those near each end of the lake, fluctuates markedly under the influence of the winds, varying with the direction, strength, and persistence

of the latter. At the eastern end of the lake westerly winds pile up the water in Buffalo Harbor and increase the depth in the Niagara River, while easterly winds drive the water out of Buffalo Harbor and lessen the flow and depth of the Niagara River. The winds produce exactly the reverse effect at the western end of the lake, their maximum effect being at Sandusky, Toledo, and the mouth of the Detroit River, as specially noted in the descriptions of these localities. Intermediate points are not subject to as great changes of level due to wind as those at the ends of the lake, and for other harbors on the south shore of the lake it may be stated in a general way that the wind fluctuations are usually less than 1 foot either way from the normal stage at the time; in rare instances an extreme fluctuation of about 2 feet may be produced.

Under the heading of Buffalo Harbor in this Bulletin are given some figures showing the stages of the water during the last 25 years, the maximum wind-produced fluctuations, etc., as observed at Buffalo. The changing stages of the lake, as well as the fluctuations due to wind, must be considered by mariners in connection with the depths of water shown on the Lake Survey charts. The present charts show depths referred to the plane of standard low water (elevation 570 feet), so that the charted depths are less than the depths actually available. The lowest water in the lake during the period of navigation (April to December) is always in the spring and fall, and it is during these times that storms are most frequent and severe.

The commerce of Lake Erie nearly all centers at the mouth of the Detroit River, from which it radiates to all

the harbors from Port Colborne, Buffalo, and the Niagara River on the east, to Toledo at the western end of the lake. The greater portion of traffic passes through the island region in the western end, and the passage between Point Pelee and Pelee Island is the most important channel of the lake. To mark this channel the Canadian Government has built a lighthouse and fog-signal station on what is known as the Middle Ground, and also maintains a light vessel with steam fog whistle on Southeast Shoal.

Natural Conditions.—Lake Erie is ordinarily calm, but being comparatively shallow, the storms which sweep over it quickly raise dangerous seas. Originally it afforded no safe and commodious harbors suitable for vessels of the size and draft now used in the lake commerce. In their unimproved condition the harbors were shallow and of variable depth at their entrances, necessitating the employment of small light-draft boats. By the combination of Government, municipal, and private work the harbors have been improved to accommodate the large lake vessels of the present era. The Maumee River near the western extremity of the lake originally limited the draft of entering vessels to $8\frac{1}{2}$ feet; Sandusky Harbor, situated within the bay of that name, to 9 feet. The harbor of Erie is a natural bay inclosed by the peninsula of Presque Isle; the entrance was from the east and naturally afforded a depth of but 6 feet, while inside there were several square miles of deep water. A few harbors, such as Dunkirk, N. Y., were formed by natural indentations in the shore line. With these exceptions, the harbors were found within the mouths of streams emptying into the lake. These streams or small rivers were generally deep

enough for harbors at that time, but their mouths were obstructed by bars at or near the line of the lake shore, which were formed by the resultant action of the lake waves and the currents of the rivers. During the season when storms were prevalent in the lake the waves washed up the sand and gravel and almost completely closed the mouths of these streams, but during the time of the spring freshets the volume of water discharged by the streams was generally sufficient to cut its way through the bars and to afford and maintain for a time channels deep enough to permit the passage of the small vessels in use at that time. These channels, however, were constantly shifting, were of uncertain and varying depth, and were liable to be obliterated temporarily by storms.

Nature of Improvements.—The first effort of improvement was directed to doing away with the bars at the river mouths, and this was effected by the construction of parallel jetties extending outward into the lake so as to prolong the natural banks of the river and to confine its discharges to a channel of moderate width. The result was invariably to secure a deeper and better entrance, limited, of course, to the extent that the discharge of the river was capable of producing. However, as the shore of the lake is generally composed of sand or material so light that it is easily disturbed, in time of storms when the waves break heavily upon the shore, the water, as far out as it is shallow enough for the wave action to make itself felt upon the bottom, is filled with sand held temporarily in suspension. The natural currents in the lake, which are generally strongest at such times, move this silt-laden water around the ends of jetties and a

portion of its burden is dropped in such a way as to form a bar out in the lake beyond or across the improved channels. This effect is further increased by the silt brought down the river in the time of floods and deposited in the still water of the lake.

The shoaling due to this bar formation and the demand for deeper channels due to the increased size of vessels rendered necessary a resort to dredging, with the result that every harbor of any commercial value on the lake has been artificially deepened by dredging. The jetties in most instances have lost their primitive function, which was an active one—namely, to cause a scouring out of the channel—and have become simply conservative in their nature. Their office is to protect and to help to maintain the artificial channels which have been secured by dredging. At Toledo no jetties have been constructed to protect the dredged channel, but at practically all other ports such jetties or piers exist.

At ports of large commercial value, additional works in the form of breakwaters have been constructed to furnish a sheltered area outside and beyond the river mouths. These areas, like the improved channels, have also a tendency to shoal. Such areas sheltered by breakwaters exist on an extensive scale at Buffalo, Cleveland, and Port Colborne (entrance to Welland Canal), and on more limited plans at Conneaut, Ashtabula, Fairport, and Lorain.

It is evident, therefore, that the harbor works of Lake Erie consist of certain areas and channels in inner harbors artificially deepened by dredging, with structures maintained for the protection and preservation of the dredged areas, and other works such as breakwaters to cover and protect

anchorage, furnish mooring facilities, and make commercial harbors outside of the small and contracted river and creek harbors. No works that can be devised, however, will prevent the beach sand from being lifted and scattered by the waves in time of storms, or the rivers from bringing down their annual burden of silt. The utmost that can be hoped for in the way of permanence is to secure the construction of jetties and breakwaters of imperishable materials and of sufficient strength to resist indefinitely the forces to which they are exposed. After this it will only be necessary to maintain the depths sought by redredging as frequently as the local conditions may require.

NIAGARA RIVER ABOVE NIAGARA FALLS

The depths herein given are referred to the sloping surface of the river corresponding to a Lake Erie stage of 570.8 feet above mean sea level, which elevation is the project plane of low-water datum for that lake. Depths on the Lake Survey chart of Upper Niagara River, referred to standard low water, are generally 1 foot less than those herein published.

GENERAL DESCRIPTION

Dimensions.—Lake Erie, converging at its eastern end into comparatively narrow outlines, has its outlet in the Niagara River. For a distance of $4\frac{3}{4}$ miles from its head the river flows through a single channel from 1,600 to 5,000 feet wide; then it is divided into two channels by Strawberry and Grand Islands, the western or Canadian channel being about 12 miles long and from 2,000 to 4,000 feet wide, and the eastern

or American channel being about 15 miles long and from 1,500 to 2,500 feet wide above Tonawanda and from 2,500 to 4,000 feet wide below Tonawanda. At the foot of Grand Island these two channels again merge into one channel about 3 miles long and from 4,000 to 7,500 feet wide, extending to the great rapids and falls, which are about 20 miles from the head of the river by the shortest channel.

The current of the river at its head begins at about the location of Horseshoe Reef. For about $1\frac{3}{4}$ miles the river is wide, shallow, and rocky, and the current is from 2 to 3 miles per hour. Thence for about 2 miles follows the engorged section, beginning about $\frac{1}{8}$ mile above the Buffalo waterworks old intake crib and extending past the International bridge to the foot of Squaw Island. This engorged section is 1,600 to 2,000 feet wide, the narrowest part being the upper $\frac{3}{4}$ mile in the vicinity of the old waterworks crib, at which point the velocity of the current is estimated to be 4 to 5 miles per hour at low to mean stages of the river and 5 to 7 miles per hour at high stages. From a point about $\frac{5}{8}$ mile below the old waterworks crib to the foot of Squaw Island the channel is deep, somewhat wider, and the current less rapid than at the narrowest part of the gorge section. Numerous observations of the current velocity, made at and just below the International bridge in connection with river discharge work, determine the velocity near midstream to be 4 miles per hour at low to mean stages and $4\frac{3}{4}$ to 5 miles per hour at high stages.

The two channels around Strawberry and Grand Islands have currents varying from 1 to 4 miles per hour.

River Discharge.—The mean level of Lake Erie for the

years 1860 to 1922, both inclusive, is about 572.51 feet above sea level. The discharge of the Niagara River for this elevation of the lake is 210,000 cubic feet per second. The increase in discharge per foot rise of the lake is approximately 22,100 cubic feet per second.

The fall of the river, taken at the respective mean levels of Lakes Erie and Ontario for the years 1860 to 1922, is 326.35 feet. Details of the approximate fall are shown by the following table, derived from observations of the U. S. Lake Survey:

From Lake Erie—	Feet
To waterworks intake.....	3.08
To foot of Squaw Island.....	5.12
To Riverside Park.....	5.62
To Rattlesnake Island.....	6.30
To head of Tonawanda Island.....	6.57
To head of Cayuga Island.....	8.31
To Echota	8.84
To Grass Island.....	10.52

Just below Grass Island the Niagara waters begin their rapid descent to the level of Lake Ontario through the rapids above the falls, the great falls themselves, and the rapids below the falls, with the following approximate descents:

	Feet
The upper rapids.....	50
The Niagara Falls.....	167
The lower rapids.....	98
Niagara River below Lewiston.....	0.5

Navigable Channels.—In its original condition the navigation of Niagara River from Lake Erie to Tonawanda was obstructed by reefs which materially limited the draft of vessels traversing it. Improvements have been made by the Government with a view to providing a channel 400 feet wide in the open river from its head to the north line of North Tonawanda, and dredging Tonawanda Harbor and Tonawanda Creek to the State dam, all to a depth of 16 feet. This work has been completed except for $\frac{1}{4}$ mile at Buffalo waterworks old intake pier, where the channel width is about 100 feet, and from the Donner Steel Co.'s front to the north line of North Tonawanda, where the depth along the wharves is from 10 to 13 feet.

The above-mentioned improvements have been amplified by the improvement of Black Rock Channel, so as to provide a channel 400 feet wide and 21 feet deep from the head of the river through Black Rock Canal and Ship Lock, and thence downstream about $2\frac{1}{2}$ miles through Strawberry Reef to the deep water of the river above Tonawanda.

The currents in the Niagara River from its head to the foot of Squaw Island are very strong and somewhat variable and the bottom is generally rocky; the channel has shoaled in places since its completion, and vessels should use great care in navigating it and in passing the old waterworks intake pier. The Black Rock Canal affords an alternative deep route from Lake Erie at Buffalo north entrance to the foot of Squaw Island, where it connects with the river by means of a ship lock accommodating large vessels; its present available depth is 18 feet at low-water datum.

From the foot of Squaw Island, passing on either side

of Strawberry and Grand Islands, an available depth of 21 feet has been obtained to Tonawanda in the American channel, and of 13 feet to Chippawa and Navy Island in the Canadian channel, but these depths are materially less at fluctuating low stages. Buoys marking the above channels are shown on the chart and fully described in the printed lists issued by the U. S. Bureau of Lighthouses. The Canadian channel between Grand Island and the Canadian shore is generally wide, but there are bars with narrow channels and limiting depths of 13 or 14 feet at Strawberry and Beaver Islands, Black Creek, Eagle Park, and opposite Navy Island.

The American channel from Tonawanda to Niagara Falls, N. Y., is little used except by excursion boats running to points along the shore of Grand Island. This channel is 10 feet deep except over scattered bowlders above Cayuga Reef, on which the depth is 8 to 10 feet. In July, 1911, Cayuga Reef channel was dredged to its full required width of 200 feet for the whole length of the reef, 1,000 feet, to a depth of 10 to 11 feet; small vessels and motor boats should not run across the channel edge between the black spar buoys. Schlosser Channel at Conners Island is 13 feet deep and 200 feet wide.

NIAGARA RIVER BELOW NIAGARA FALLS

The lower Niagara River, navigable from Lewiston (at the foot of the lower rapids) to its mouth, a distance of 7 miles, has an unobstructed channel from 1,500 to 2,000 feet wide, 30 to 70 feet deep, and capable of floating the largest

ships. There are shoals off the entrance, however, which make it necessary to exercise care in entering the river. A red gas and bell buoy, showing an occulting red light, marks the outer, easterly point of Niagara Bar, about 2.9 miles 350° (N. $\frac{7}{8}$ W.) from Fort Niagara Light, and a black bell buoy marks the northwest extremity of the shoal making out from the east side of the mouth of the river, 5,200 feet NW. $\frac{1}{8}$ N. from Fort Niagara Light.

WELLAND CANAL, ONT.

The main line of the present canal leaves Lake Erie at Port Colborne and enters Lake Ontario at Port Dalhousie, being $26\frac{3}{4}$ miles long. It has a total descent of $326\frac{3}{4}$ feet, to overcome which there are 25 lift locks, each 270 feet long (available length about 255 feet) by 45 feet wide, and designed to have 14 feet depth on the sills. However, on the upper sill of lock No. 26 at Port Colborne, the depth reduces to less than 13 feet at the stage of low-water datum in Lake Erie, and the depth is further subject to change during fluctuations in that lake due to wind. In 1922, the actual depths on the above-mentioned lock sill varied from a minimum of 8 feet 2 inches to a maximum of 13 feet 6 inches. Besides the regular lift locks, there are one pair of guard gates and one guard lock. Vessels are restricted to 4 miles per hour in passing through the canal reaches. Across the canal are numerous bridges which swing on signal.

The Welland Canal formerly had two entrances at its Lake Ontario end at Port Dalhousie, one of which pertained to the old line and the other for the present canal, and two sepa-

rate lines of canal were available from Port Dalhousie to Allanburg, a distance of $12\frac{1}{2}$ miles by the old line and $11\frac{3}{4}$ by the present canal. The old line has been abandoned for traffic purposes.

The long level from Allanburg to Port Colborne, 15 miles, is a single channel, the old line having been enlarged as part of the present canal, and the sill of the Port Colborne guard lock lowered.

New Welland Ship Canal.—In order to provide accommodation for a larger class of vessels than those that can pass through the present canal, operations were begun in 1913 for the construction of a new ship canal between Lakes Erie and Ontario. In 1916, these operations were suspended on account of the war, but were resumed in 1919. The line of proposed canal follows the course of the present canal from Port Colborne to Allanburg, about halfway across the peninsula. Thence an entirely new channel will be provided, crossing the present canal just below lock No. 25 and again below lock No. 11, at which points the surface elevations of the two canals coincide. The canal will enter Lake Ontario at the mouth of Ten Mile Creek, about 3 miles east of the Port Dalhousie terminus of the present canal. The new terminus is known as Port Weller.

The total length of the new line is 25 miles, and the difference in level between the two lakes, about $325\frac{1}{2}$ feet, will be overcome by seven lift locks, each having a lift of $46\frac{1}{2}$ feet. The locks will have available length of 812 feet, clear width of 80 feet, and 30 feet of water over the miter sills at lowest lake stages. The canal prism will be 200 feet wide at the bottom, and the depth will be 25 feet; but all structures will

be sunk to 30 feet depth, so that the canal can be deepened at any future time by dredging out the reaches.

Operations are being prosecuted in sections comprising not quite one-half of the total length, but including the seven locks and most of the heavy construction work upon which the eventual completion more largely depends. The work which is being deferred for later performance consists principally of excavation necessary to widen and deepen parts of the present line or to straighten the line by new cut, and also the building of a guard lock near Port Colborne.

LAKE ONTARIO

The depths herein given are referred to low-water datum, the reference plane for United States river and harbor improvements, which for Lake Ontario is an elevation 244.5 feet above mean sea level. Depths on the Lake Survey charts, referred to standard low water, are generally $1\frac{1}{2}$ feet less than those herein published.

DIMENSIONS, SURFACE ELEVATIONS, ETC.

[All elevations are expressed in terms of the adjusted levels of 1903.]

Length, steamer track, Burlington Bay		
Light to head of St. Lawrence River		
(Tibbetts Point)	miles..	180
Length, steamer track, Port Dalhousie		
to head of St. Lawrence River		
(Tibbetts Point)	miles..	160
Length (right line), west end of Burlington		
Bay to Sacketts Harbor	miles..	193

Breadth (right line), about			
longitude 77° 35'.....miles..			53
Depth, maximum recorded by Lake			
Survey	feet..		738
Areas in square miles:	United States	Canada	Total
Water surface of lake *... 3,560		3,980	7,540
Entire drainage basin *... 18,720		15,920	34,640
Rainfall, average annual.....	inches..		33
High water, mean sea level of May, 1870,			
above mean sea level.....	feet..		248.95
Standard low water (adopted for charts),			
above mean sea level.....	feet..		243.00
Extreme low water (low water of 1895),			
above mean sea level.....	feet..		243.41
Mean surface, 63 years, 1860-1922,			
above mean sea level.....	feet..		246.16
Mean surface below mean surface of			
Lake Erie.....	feet..		326.35
Discharge of St. Lawrence River at mean			
stage of Lake Ontario (246.16)			
.....	cubic feet per second..		240,800
Increase in discharge per foot rise of lake.....			
.....	cubic feet per second..		21,500
Season of navigation, average dates:	Opening	Closing	
Welland Canal.....	Apr. 17	Dec. 10	
Toronto, Ontario.....	Mar. 21	Dec. 19	
Oswego, N. Y.....	Apr. 5	Dec. 13	
Cape Vincent, N. Y.....	Apr. 8	Dec. 31	

* Including Niagara River and St. Lawrence River to Galop Rapids.

GENERAL DESCRIPTION

Fluctuations of Water Level.—The average or normal elevation of the lake surface varies irregularly from year to year. During the course of each year, the normal level is subject to a consistent seasonal rise and fall, its lowest stages prevailing during the winter months and its highest stages during the summer months. In the last five years, the highest annual stages (taking the maximum monthly height of each year) have ranged from 1.20 to 3.29 feet above low-water datum, and the lowest annual stages (taking the minimum monthly mean height of each year) have ranged from 0.06 foot below to 1.21 feet above low-water datum, to which depths are referred in the descriptions following. In the 63 years from 1860 to 1922, the difference between the highest (248.95) and the lowest (243.41) monthly mean stages of the whole period was 5.54 feet; the greatest annual fluctuation as shown by the highest and the lowest monthly means of any year was 3.65 feet, and the least annual fluctuation was 0.69 foot.

In addition to the annual fluctuation, there are occasional oscillations of irregular amount and duration. Sometimes these are apparently seiches, resulting from variations in barometric pressure, which may produce changes ranging from a few inches to several feet, and return to normal, within a few hours. At other times the level may be affected by winds of sufficient velocity to drive the surface water forward in greater volume than that carried by the lower return

currents, thus raising the elevation on the lee shore and lowering it on the weather shore. This result is materially augmented in bays and at extremities of the lake, where the impelled water is concentrated in a restricted space by the converging shores, especially if coupled with a gradually sloping inshore bottom which reduces the depth and checks the reverse flow via lower currents.

Physical Conditions.—Lake Ontario is the smallest of the Great Lakes. It is comparatively deep, its maximum depth being 738 feet, and its average depth much in excess of that of Lake Erie. The great depth materially limits the fluctuations of level due to wind, rendering them comparatively small. It is little obstructed by ice, never freezing except near land. As a general rule, Lake Ontario is free from outlying shoals or dangers. The only shoals dangerous to navigation are those found in the vicinity of Prince Edward County and among the small islands in the northeastern part of the lake, and those off the mouth of the Niagara River, known as Niagara Bar. The last-named shoals are in the course of vessels entering and leaving Niagara River, and near the path of vessels plying between Welland Canal and the lake ports to the east and the St. Lawrence River.

The commerce of Lake Ontario is limited in comparison with that of the lakes above Niagara Falls, and is in general confined to vessels which can pass the Welland Canal and the St. Lawrence canals; the harbors on the lake are planned to accommodate vessels limited to the size determined by the dimensions of the locks, which are: Length 270 feet, width

45 feet, and depth 14 feet on sills. The United States commerce on the lake is generally confined to coal shipped from Charlotte, Sodus Bay, Little Sodus Bay, and Oswego to Canadian ports on the lake and United States and Canadian ports on the St. Lawrence River; to coal from Oswego to upper lake ports; to grain and other products shipped from upper lake ports through the Welland Canal to St. Lawrence River points; to lumber from Canadian ports; and to pleasure traffic.

Improvements.—Most of the commercial harbors on the lake have been improved by work at their entrances, including the building of jetties and dredging; in addition, at Oswego a breakwater has been built, making an outer harbor.

Vessels and tows coming up the St. Lawrence River, on approaching Lake Ontario, often find that storm conditions render it unsafe for them to venture into the open lake. Formerly they had no place to lay up except by running down the river under the lee of an island. To meet this want the United States has constructed a breakwater at Cape Vincent, near the head of the St. Lawrence.

The general result of the improvements provided by the United States Government is to give harbor facilities for vessels drawing not more than 14 feet of water. At many of the harbors periodical shoaling takes place, due to sand driven by winds and storms and to detritus brought down by streams, and systematic dredging is required to maintain the channels.

STORM-WARNING DISPLAY STATIONS

Maintained by the United States and Canadian
Governments at Points on the Great Lakes

DISPLAY SIGNALS

UNITED STATES—Small Craft Warning.—A red pennant indicates moderately strong winds will interfere with safe operation of small craft. No night display.

Violent storms are indicated by day signals comprising a square red flag with black square center and either a red or a white pennant, and by night signals composed of lanterns, either red or red and white; the color and position of the pennants or lights showing the initial direction of the wind, as follows:

Northeast Storm.—Red pennant above square flag; or two red lanterns, one above the other.

Southeast Storm.—Red pennant below square flag; or one red lantern.

Southwest Storm.—White pennant below square flag; or white lantern below red lantern.

Northwest Storm.—White pennant above square flag; or white lantern above red lantern.

Hurricane Warning.—Two square flags, one above the other; or two red lanterns with white lantern between; indicates an extremely severe or dangerous storm.

CANADA. The day signals consist of a cone displayed alone to indicate moderate gales with wind velocity from 25

to 35 miles an hour, and a drum suspended with the cone for heavy gales with wind exceeding 35 miles an hour. The night signals are composed of lanterns, either red or red and white. Wind directions are indicated as follows:

Easterly Winds.—Cone pointing downward, either alone or with drum above it; or one red lantern.

Westerly Winds.—Cone pointing upward, either alone or with drum below it; or white lantern below red lantern.

In the following list, night signals are displayed at stations where lights are specified.

LANE SUPERIOR

Ashland, Wis.—Steel tower, with lights.—On bay front at foot of Second Avenue west, near intersection with Front street.

Bayfield, Wis.—Steel tower, with lights.—On south side of foot of Rittenhouse avenue, directly west of inner end of city dock.

Deer Park, Mich.—Flagstaff.—On bluff back of coast-guard station, near mouth of Sucker River.

Duluth, Minn.—Steel tower, with lights.—On southwest side of Weather Bureau building, corner Eighth street and Seventh avenue west. (See also Superior, below.)

Eagle Harbor, Mich.—Steel tower, with lights.—About 200 feet northwest of lighthouse.

Fort William, Ont.—Signal mast, with lights.—At upper end of C. P. R. freight shed No. 5, 125 feet from the river.

Grand Marais, Mich.—Steel tower, with lights.—On coast-

guard reservation, west side of harbor entrance, about 800 feet from lake.

Houghton, Mich.—Steel tower, with lights.—On roof of new Masonic Temple, corner Shelden and Portage streets.

Keweenaw Waterway, Mich.—Steel tower, with lights.—On easterly side of Upper Entrance, about 100 feet south of coast-guard station. Steel tower, with lights.—At Portage Entry, near U. S. watchman's residence. (See also Houghton, above.)

Marquette, Mich.—Steel tower, with lights.—On Marquette County Savings Bank building, southeast corner of Washington and Front streets.

Mendota Light Station, Mich.—Steel tower, with lights.—About 75 feet north of the lighthouse and 50 feet from the canal.

Munising, Mich.—Steel tower, with lights.—On east side of Beach Inn, about 240 feet from bay shore.

Ontonagon, Mich.—Flag pole (day signals).—About 75 feet east of light house.

Pequaming, Mich.—Steel tower, with lights.—On the lake shore about 750 feet northeast of Hebard's sawmill.

Port Arthur, Ont.—Steel tower, with lights.—On roof of customhouse.

Presque Isle, Mich.—Steel tower, with lights.—Immediately across railroad track north of Lake Superior & Ishpeming depot.

Sault Ste. Marie, Mich. (St. Marys River).—Steel tower, with lights.—Twenty-five feet northwest of Weather Bureau building, Canal grounds, Portage avenue west.

Sault Ste. Marie, Ont. (St. Marys River).—Signal mast,

with lights.—On southeast corner of Government wharf at foot of Pim street.

Skaneec, Mich.—Flagpole (day signals).—About 500 feet east of dock, $\frac{1}{4}$ mile west of Skaneec post office.

Superior, Wis.—Steel tower, with lights.—On outer end of Great Northern Railway ore dock No. 1, facing Superior Entry. (See also Duluth, above.)

Two Harbors, Minn.—Steel tower, with lights.—On outer end of Duluth & Iron Range Railroad ore dock No. 6

Washburn, Wis.—Steel tower, with lights.—Near bay front, First avenue east near C., St. P., M. & O. Railway depot.

Whitefish Point, Mich.—Steel tower, with lights.—About 667 feet ENE. of lighthouse.

LAKE MICHIGAN

Beaver Island (St. James), Mich.—Steel tower, with lights.—On Church Hill, 1 mile south of St. James.

Big Sable Point, Mich.—Steel tower, with lights.—On coast-guard reservation.

Calumet Harbor (South Chicago), Ill.—Steel tower, with lights.—On southwest corner of lighthouse reservation. (See also Chicago, below.)

Charlevoix, Mich.—Steel tower, with lights.—On bluff, south side of harbor, about 250 feet east of coast-guard station.

Chicago, Ill.—Steel tower, with lights.—On northeast corner of outer end of municipal pier No. 2. (See also Calumet above.)

Escanaba, Mich.—Steel tower, with lights.—A short distance north of Ludington street and west of Tilden avenue.

- Frankfort, Mich.—Steel tower, with lights.—A coast-guard station, south side of harbor entrance.
- Gladstone, Mich.—Flagstaff, with lights.—On roof of elevator, “Soo Line” dock.
- Glen Haven, Mich.—Steel tower, with lights.—On outer end of Day’s pier.
- Grand Haven, Mich.—Steel tower, with lights.—On Cutler block, southwest corner Third and Washington streets, $1\frac{1}{2}$ miles from pier entrance, 1,400 feet from docks.
- Green Bay (city), Wis.—Steel tower, with lights.—On Minahan building, 110–116 Walnut street.
- Harbor Springs, Mich.—Steel tower, with lights.—At foot of Spring street.
- Holland, Mich.—Steel tower, with lights.—At coast-guard station, Macatawa Park.
- Kenosha, Wis.—Steel tower, with lights.—On old lighthouse tower, about 400 feet north of inner end of entrance channel.
- Kewaunee, Wis.—Steel tower, with lights.—On south bluff near the lake and about two blocks from center of city.
- Ludington, Mich.—Steel tower, with lights.—At coast-guard station, north side of harbor entrance.
- Manistee, Mich.—Steel tower, with lights.—At coast-guard station, north side of harbor entrance.
- Manitowoc, Wis.—Steel tower, with lights.—At foot of North Seventh street, about 15 feet from river dock.
- Menominee, Mich.—Flagstaff, with lights.—On roof of fire department engine house, 250 feet from the bay shore and 3,700 feet north of the north pier.
- Michigan City, Ind.—Steel tower, with lights.—On coast-

guard reservation, about midway between station and sea wall to the north.

Milwaukee, Wis.—Steel tower, with lights.—On Jones Island, south of entrance channel, about 100 feet from shore line.

Muskegon, Mich.—Steel tower, with lights.—At coast-guard station, south side of harbor entrance.

North Manitou Island, Mich.—Steel tower, with lights.—On coast-guard reservation, northeast part of island.

Northport, Mich.—Steel tower.—At end of main dock.

Pentwater, Mich.—Steel tower, with lights.—On coast-guard reservation, north side of entrance channel.

Plum Island, Wis.—Steel tower, with lights.—On northeast point of island, 56 feet east of coast-guard station.

Racine, Wis.—Steel tower, with lights.—On northwest corner of coast-guard station.

St. Joseph, Mich.—Steel tower, with lights.—On bluff in Lake Front Park.

Sheboygan, Wis.—Steel tower, with lights.—At coast-guard station, north side of harbor entrance.

South Haven, Mich.—Steel tower, with lights.—On light-house reservation, south side of channel near the coast-guard station.

South Manitou Island, Mich.—Steel tower, with lights.—At south point of South Manitou Harbor on coast-guard reservation.

Sturgeon Bay, Wis.—Steel tower, with lights.—South side foot of Spruce street, near corner of Main street.

Traverse City, Mich.—Flagstaff.—On State Bank building.

Two Rivers, Wis.—Steel tower, with lights.—In front of

coast-guard station, north side of harbor entrance near the pier.

LAKE HURON

Alpena, Mich.—Steel tower, with lights.—In rear of the Federal building.

Bay City, Mich.—Steel tower, with lights.—On Jennison Hardware Company's building, foot of Fifth street.

Bayfield, Ont.—Signal mast.—On south bank overlooking lake and harbor.

Cabot Head, Ont.—Steel tower, with lights.—Eighty feet southwest of Cabot Head Lighthouse.

Cheboygan, Mich.—Steel tower, with lights.—Foot of Main street.

Collingwood, Ont.—Signal mast, with lights.—At foot of Hurontario street, adjacent to the Government dock.

Depot Harbor, Ont.—Signal mast, with lights.—On summit of Supply Point.

Detour, Mich. (St. Marys River).—Steel tower, with lights.—On Dawson street, about 500 feet from the river front.

Goderich, Ont.—Signal mast, with lights.—On lake bank 80 feet northwest of lighthouse.

Harbor Beach, Mich.—Steel tower, with lights.—On lake front at foot of Lytle street.

Kincardine, Ont.—Signal mast, with lights.—On west side of Huron Street, east side of harbor basin and a little south of entrance.

Mackinac Island, Mich.—Steel tower, with lights.—Extreme south end of island, directly opposite Round Island Light.

- Mackinaw, Mich.—Steel tower, with lights.—Near water's edge, about one-quarter mile north of the railroad pier.
- Middle Island, Mich.—Steel tower, with lights.—On northwest side of island, 400 feet northeast of coast-guard station.
- Midland, Ont.—Signal mast, with lights.—On high hill on south side of harbor entrance, visible to vessels bound to and from Victoria Harbor.
- Oscoda, Mich.—Steel tower, with lights.—On lake shore at steamboat dock.
- Owen Sound, Ont.—Signal mast, with lights.—On west side of river, about 12 feet east of Stephens street and 135 feet north of Fourth avenue west.
- Parry Sound, Ont.—Signal mast, with lights.—On rocky bluff known as Bobs Point, immediately to east of entrance channel and about 900 feet west of town wharf.
- Port Huron, Mich. (St. Clair River).—Flagstaff, with lights.—On roof of Federal building, corner Water and Sixth streets. Steel tower, with lights. At Miller's coal dock, 2322 Military street, on bank of river.
- Port McNicoll, Ont.—Signal mast, with lights.
- Presque Isle, Mich.—Steel tower, with lights.—On the point, 300 feet east of lighthouse.
- Sarnia, Ont. (St. Clair River).—Signal mast, with lights.—At foot of George street, immediately adjoining water-works property.
- Southampton (Saugeen), Ont.—Signal mast, with lights.—At corner of High and Lake streets, midway between the river and the harbor of refuge, 150 feet from the fog whistle.

Tawas Point, Mich.—Steel tower, with lights.—On lake side of the point, 150 feet southwest of the coast-guard station.

Thunder Bay Island, Mich.—Steel tower, with lights.—At extreme southeast end of island.

Tobermory, Ont.—Signal mast, with lights.—On hill to left of harbor entrance, opposite lighthouse.

Wiarton, Ont.—Signal mast, with lights.—On outer end of breakwater, 500 feet from shore.

LAKE ERIE

Amherstburg, Ont. (Detroit River).—Signal mast, with lights.—At entrance to dock at waterworks park.

Ashtabula, Ohio.—Steel tower, with lights.—On the shore at coast-guard station at the foot of Franklin street.

Buffalo, N.Y.—Steel tower, with lights.—On New York Telephone Company building, corner Franklin and Church streets. Steel tower, with lights.—At coast-guard station on south pier at mouth of Buffalo River. (See also Stony Point.)

Cleveland, Ohio.—Steel tower, with lights.—On the east pier near its outer end, and across from the coast-guard station.

Conneaut, Ohio.—Steel tower, with lights.—On high bluff, 400 feet west of dock No. 1.

Detroit, Mich. (Detroit River).—Steel tower and flagstaff, with lights.—On roof of Majestic building, Woodward and Michigan avenues, 2,000 feet from river.

Dunkirk, N. Y.—Steel tower, with lights.—On triangle between Eagle street dock and Scully lumber dock on lake front.

- Erie, Pa.—Steel tower, with lights.—On public dock, State street extension, 105 feet from outer end.
- Fairport, Ohio.—Steel tower, with lights.—East side of river, on bluff 49 feet above P. & L. E. Dock Company's office.
- Huron, Ohio.—Steel tower, with lights.—At foot of Main street, 90 feet west from west shore of river.
- Kelleys Island, Ohio.—Steel tower, with lights.—South side of island, on bluff near dock of Kelleys Island Dock & Steamboat Company.
- Long Point, Ont.—Signal mast, with lights.—About 150 feet northeasterly from Long Point Lighthouse.
- Lorain, Ohio.—Steel tower, with lights.—On east side of Black River, near the coast-guard station.
- Pelee Island, Ont.—Signal mast, with lights.—At the extreme northern point of Pelee Island.
- Point Marblehead, Ohio.—Steel tower, with lights.—Ninety-three feet east of coast-guard station and 50 feet south of lake shore line.
- Port Burwell, Ont.—Signal mast, with lights.—At southernmost limit of Robinson street, on eminence east of the east pier, and south of the lighthouse.
- Port Colborne, Ont.—Signal mast, with lights.—On east side of harbor, 500 feet south of canal bridge.
- Port Dover, Ont.—Signal mast, with lights.—At extreme end of west pier at foot of Main street.
- Port Stanley, Ont.—No mast, but warnings are posted at the post office.
- Put-in-Bay, Ohio.—Steel tower.—Head of pier at village park, lake front, 10 feet west of intersection of Bay View and Hartford avenues.

- Sandusky, Ohio.—Steel tower, with lights.—On north water front of dock at foot of Jackson street. (See also Venice.)
- Stony Point, N. Y.—Steel tower, with lights.—At Lackawanna Steel Company's plant, 225 feet NE. of NE. corner of dock office.
- Toledo, Ohio.—Steel tower, with lights.—At Toledo Yacht Club, on west bank of Maumee River, facing Maumee Bay.
- Tonawanda, N. Y. (Niagara River).—Steel tower, with lights.—At lock connecting the Erie Canal with Tonawanda Creek.
- Venice, Ohio.—Flagstaff.—On front of store and post office, south shore of Sandusky Bay.
- Vermilion, Ohio.—Flagstaff.—About 1,575 feet SSW. of lighthouse and 200 feet from lake shore.

LAKE ONTARIO

- Burlington, Ont.—Signal mast.—On main lighthouse, south wharf, eastern entrance.
- Cape Vincent, N. Y. (St. Lawrence River).—Steel tower, with lights.—On the L-shaped wharf near the upper end of the village front at the foot of Market street.
- Charlotte, N. Y.—Steel tower, with lights.—At coast-guard station, east side of harbor entrance.
- Cobourg, Ont.—Signal mast, with lights.—On east pier, near the shore line.
- Deseronto, Ont.—Signal mast, with lights.—Adjoining lighthouse on Depot wharf, foot of Main street.
- Fort Niagara, N. Y. (Niagara River).—Steel tower, with lights.—About 27 feet west of coast-guard station, east bank of Niagara River.

- Kingston, Ont.—Signal mast, with lights.—At the city pumping station.
- North Fairhaven, N. Y.—Steel tower, with lights.—Near Customhouse on bay.
- Oakville, Ont.—Signal mast, with lights.—On east side of river at foot of Navy street, overlooking the east pier.
- Ogdensburg, N. Y. (St. Lawrence River).—Steel tower, with lights.—In middle of Caroline street, 200 feet from North Water street, river front.
- Oswego, N. Y.—Steel tower, with lights.—On the fort bank, about 185 feet southeast of coast-guard station, Fort Ontario.
- Port Credit, Ont.—Signal mast, with lights.—On beach on north side of harbor, near inner end of north pier.
- Port Dalhousie, Ont.—Signal mast, with lights.—At center of harbor, on point dividing old and new canals.
- Port Hope, Ont.—Signal mast, with lights.—On wharf at foot of Mill street.
- Prinyer, Ont.—Signal mast, with lights.—On south side of entrance to Prinyer Cove, $1\frac{1}{2}$ miles west of upper gap between Bay of Quinte and Lake Ontario.
- Sacketts Harbor, N. Y.—Steel tower, with lights.—On bluff at northwest end of Main street.
- Sodus Point, N. Y.—Steel tower, with lights.—On the Northern Central Railway grounds.
- Toronto, Ont.—Signal mast, with lights.—Adjoining fog-alarm building at eastern entrance to harbor. Signal mast.—On Toronto Harbor Commission wharf, foot of Yonge street.

COAST-GUARD STATIONS

Maintained by the United States on the Great Lakes,
Including Canadian Life-Saving Stations

LAKE SUPERIOR

*Deer Park, Mich.—Near mouth of Sucker River 15½ miles easterly of Grand Marais, Mich.

Duluth, Minn.—On Minnesota Point, about ½ mile southerly from Duluth Ship Canal.

Eagle Harbor, Mich.—On east point of harbor.

Grand Marais, Mich.—Four hundred feet west of rear range light.

Marquette, Mich.—Near inner end of U. S. breakwater.

Portage, Mich.—Near the lake shore on easterly side of northerly end of Upper Canal, Keweenaw Waterway.

*Two Hearted River, Mich.—Near mouth of Big Two Hearted River, 26½ miles easterly from Grand Marais, Mich.

Vermilion Point, Mich.—Ten miles west of Whitefish Point.

Whitefish Point, Mich.—About 800 feet ENE. of Whitefish Point Light.

LAKE MICHIGAN

Bailey Harbor, Wis.—On easterly side of harbor.

*Beaver Island, Mich.—Near light in harbor.

*Big Sable Point, Mich.—One mile south of light on Big Sable Point.

Calumet, Ill.—See South Chicago.

* Station is not at present in full active duty service, owing to reduced force.

Charlevoix, Mich.—South side of entrance to harbor.

Chicago, Ill.—One on north side of yacht harbor, Jackson Park. One on south side of entrance to Chicago River, at north end of easterly breakwater. See also South Chicago.

Evanston, Ill.—On the Northwestern University grounds, about $\frac{7}{8}$ mile south of Grossepoint Light.

Frankfort, Mich.—South side of entrance to harbor.

Grand Haven, Mich.—North side of entrance to harbor.

Holland, Mich.—South side of harbor entrance.

Kenosha, Wis.—In the harbor, on Washington Island.

Kewaunee, Wis.—North side of entrance to harbor.

Ludington, Mich.—North side of entrance to harbor.

Manistee, Mich.—North side of entrance to harbor.

Michigan City, Ind.—East side of entrance to harbor.

Milwaukee, Wis.—In McKinley Park, north end of breakwater.

Muskegon, Mich.—South side of entrance to harbor.

North Manitou Island, Mich.—Near Pickard's wharf, east side of island.

*Pentwater, Mich.—North side of entrance to harbor.

Plum Island, Wis.—Near northeast point of island, about $2\frac{3}{8}$ miles northwest of Pilot Island Light.

*Point Betsie, Mich.—Near the lighthouse.

Racine, Wis.—Near inner end of north pier.

St. Joseph, Mich.—North side of harbor entrance.

Sheboygan, Wis.—Near inner end of old north pier stub.

Sleeping Bear Point, Mich.—About $1\frac{1}{2}$ miles northwesterly from Glen Haven.

* Station is not at present in full active duty service, owing to reduced force,

South Chicago, Ill.—North side of entrance to Calumet Harbor.

South Haven, Mich.—South side of entrance to harbor, near the shore line.

South Manitou Island, Mich.—South side of harbor, $\frac{1}{4}$ mile north of light.

Sturgeon Bay Canal, Wis.—At easterly entrance, on north side.

Two Rivers, Wis.—North side of entrance to harbor.

*White Lake, Mich.—North side of entrance to White Lake.

LAKE HURON

Bois Blanc Island, Mich.—At Walkers Point, east side of island.

Collingwood, Ont.—At inner end of east breakwater.

Goderich, Ont.—Boat house on the south entrance pier.

Hammond, Mich.—On east point of Hammond Bay.

Harbor Beach, Mich.—In the harbor, inner end of dock.

Kincardine, Ont.—On east shore of harbor.

Lakeview Beach, Mich.—Five miles north of Fort Gratiot Light.

Mackinac Island, Mich.—In the harbor.

Middle Island, Mich.—On north end of the island, about $\frac{5}{8}$ mile northwest of light.

Pointe aux Barques (Light), Mich.—Near the lighthouse.

*Port Austin, Mich.—On Pointe aux Barques, about 2 miles northeast of Port Austin, and about 2 miles southeast of Port Austin Reef Light.

* Station is not at present in full active duty service, owing to reduced force.

Southampton, Ont.—On the beach between breakwater and mouth of Saugeen River.

Sturgeon Point, Mich.—Near the lighthouse.

Tawas, Mich.—Near the lighthouse.

Thunder Bay Island, Mich.—On the west side of the island, about $\frac{5}{8}$ mile west of light.

LAKE ERIE

Ashtabula, Ohio.—On the shore, foot of Franklin street.

Buffalo, N. Y.—On the south pier at the mouth of Buffalo River.

Cleveland, Ohio.—On the west pier.

Erie, Pa.—On north side of entrance channel, near Erie Range Light No. 2.

Fairport, Ohio.—On west side of mouth of Grand River.

Long Point, Ont.—On south side of Long Point, about $1\frac{1}{2}$ miles westerly from Long Point Lighthouse.

Lorain, Ohio.—East side of mouth of Black River.

Marblehead, Ohio.—On Point Marblehead, near the quarry docks.

Point Pelee, Ont.—Near the south extremity of the point.

Port Stanley, Ont.—Near Port Stanley.

LAKE ONTARIO

* Big Sandy, N. Y.—North side of mouth of Big Sandy Creek.

Charlotte, N. Y.—East side of entrance to harbor.

* Station is not at present in full active duty service, owing to reduced force.

Cobourg, Ont.

Consecon, Ont.—East side of Weller Bay.

Niagara, N. Y.—East side of entrance to Niagara River.

Oswego, N. Y.—East side of entrance to harbor.

Port Hope, Ont.

Toronto, Ont.—At the eastern entrance, on west pier, opposite fog-alarm building.

Wellington, Ont.

HYDROGRAPHIC INFORMATION BY RADIOTELEGRAPH

The U. S. Hydrographic Office and the U. S. Naval Communication Service are prepared to collect and distribute hydrographic information by radiotelegraph. The naval radio stations will make no charge for receiving messages containing such information, provided the messages are checked "Govt. Hydro.", and will arrange to furnish this information to the nearest Branch Hydrographic Office free. The ship-sending expense, if any, will be borne by the sending vessel.

The procedure, as far as masters of vessels are concerned, consists of (a) sending hydrographic information to radio station, and (b) receiving information twice daily when in radio range of the distributing station of the zone in which it may be.

Vessels coöperating in this service should transmit messages in plain English direct to the appropriate radio stations (designated below), which stand continuous watch and will receive hydrographic messages at any time. Vessels should transmit information as soon as they are in normal radio

range of the station. The information transmitted should be as concise as is consistent with exactness and clearness, and arranged in the order of importance of the items. For uniformity, the following order of subjects is recommended:

- (1) Derelicts and sunken wrecks.
- (2) Mines.
- (3) Ice.
- (4) Aids to navigation adrift.
- (5) Floating rafts, logs, wreckage.
- (6) Misplaced buoys in approaches to harbors.
- (7) Other items sufficiently important to broadcast.

NOTE.—It is not intended that information be forwarded by radio unless danger to vessels is involved, either from collision or as a result of inadequacy of aids to navigation.

Vessels are requested to forward by first mail to the Branch Hydrographic Office concerned a copy of all radio messages sent.

Messages pertaining to various localities should be transmitted as follows:

Lake Ontario and St. Lawrence River above Montreal, to Buffalo Naval Radio Station; call letters, NNZ.

This station will broadcast information at 10.45 A. M. and 5 P. M.; wave length, 1,200 AR.

Confirmation copy of message by mail to Branch Hydrographic Office, 340 Federal Building, Buffalo, N. Y.

Lake Erie, Lake Huron, and Georgian Bay, to Cleveland Naval Radio Station; call letters, NRH.

This station will broadcast information at 11 A. M. and 5.30 P. M.; wave length, 1,080 AR.

Cleveland information is also broadcast at same hours by Alpena Station; wave length, 1,200 AR.

Confirmation copy of message by mail to Branch Hydrographic Office, 406 Federal Building, Cleveland, Ohio.

Lake Michigan, to Great Lakes Naval Radio Station; call letters, NAJ.

This station will broadcast information at 11 A. M. and 5.30 P. M.; wave length, 1,988 AR.

Confirmation copy of message by mail to Branch Hydrographic Office, 528 Federal Building, Chicago, Ill.

Lake Superior and waters connecting this lake with Lake Michigan, Lake Huron, and Georgian Bay, to Duluth Naval Radio Station; call letters, NUX.

This station will broadcast information at 10.45 A. M. and 4.45 P. M.; wave length, 1,200 AR.

Confirmation copy of message by mail to Branch Hydrographic Office, 1000 Torrey Building, Duluth, Minn.

WEATHER AND STORM-WARNING BULLETINS BY RADIOTELEGRAPH

Weather reports and storm warnings relating to the Great Lakes are broadcast daily by radiotelegraph from the stations and at the hours (75th meridian time) below indicated. Morning and night bulletins of the United States Weather Bureau are based on regular 8 A. M. and 8 P. M. observations, respectively, and afternoon bulletins are based on special observations. Vessels may also request the sta-

tions listed to furnish latest reports and storm warnings.

LAKE SUPERIOR—Duluth, Minn. (call letters NUX; transmitting wave length, 1,200 meters).—Duluth Weather Bureau wind and weather forecasts and storm warnings for Lake Superior, advisory messages relating to storm warnings for the Great Lakes, and wind direction and velocity, state of weather, and barometric pressure at certain Lake Superior Points, are broadcast at 10.45 A. M. and 10.45 P. M.; also storm warnings and advices at 4.45 P. M.

Whitefish Point, Mich. (call letters NZT; transmitting wave length, 1,200 meters).—Weather forecasts and storm warnings furnished by Chicago Weather Bureau are broadcast at 10.45 A. M. and 4.45 P. M.

Port Arthur, Ont. (call letters VBA).—Canadian forecasts are broadcast at 11.30 P. M.

Sault Ste. Marie, Ont. (call letters VBB).—Canadian forecasts are broadcast at 11.20 P. M.

LAKE MICHIGAN—Great Lakes, Ill. (call letters NAJ; transmitting wave length, 1,988 meters).—Chicago Weather Bureau wind and weather forecasts and storm warnings for Lake Michigan, advisory messages relating to storm warnings for the Great Lakes, and wind direction and velocity, state of weather, and barometric pressure for certain Lake Michigan points, are broadcast at 11 A. M. and 11 P. M.; also storm warnings and advices at 5.30 P. M.

LAKE HURON—Alpena, Mich. (call letters NSM; transmitting wave length, 1,200 meters).—Alpena Weather Bureau wind and weather forecasts and storm warnings for Lake Huron and advisory messages relating to storm warnings for the Great Lakes are broadcast at 10.45 A.M.; also

storm warnings and advices at 4.45 P. M. and 8.45 P. M. State of weather, wind direction and velocity, condition of sea, and barometric pressure at certain Lake Huron points are broadcast at 8.45 A. M., 12.45 P. M., 2.45 P. M., 4.45 P. M., 6.45 P. M., and 8.45 P. M.

Midland, Ont. (call letters VBC).—Canadian forecasts are broadcast at 11 P. M.

Point Edward, Ont. (call letters VBE).—Canadian forecasts are broadcast at 11.10 P. M.

LAKE ERIE AND ONTARIO—Cleveland, Ohio (call letters NRH; transmitting wave length, 1,080 meters).—Cleveland Weather Bureau wind and weather forecasts and storm warnings for Lake Erie, advisory messages relating to storm warnings for the Great Lakes, and wind direction and velocity, state of weather, and barometric pressure at Toledo, Cleveland, and Erie, are broadcast at 11 A. M. and 11 P. M.; also storm warnings and advices at 5.30 P. M.

Buffalo, N. Y. (call letters NNZ; transmitting wave length, 1,200 meters).—Buffalo Weather Bureau wind and weather forecasts and storm warnings for Lake Ontario, advisory messages relating to storm warnings for the Great Lakes, and wind direction and velocity, state of weather, and barometric pressure at Buffalo and Oswego, are broadcast at 10.45 A. M. and 10.45 P. M.; also storm warnings and advices at 5 P. M.

Kingston, Ont. (call letters VBH).—Canadian forecasts are broadcast at 11 P. M.

Toronto, Ont. (call letters VBG).—Canadian forecasts are broadcast when issued from the Central Meteorological Office, Toronto.

NOTES ON GREAT LAKES WEATHER AND BAROMETRIC
READINGS

Reprinted through the courtesy of the Lake Michigan Yachting Association and "Scates' Cruising Book for Lake Michigan."

In a fog sounds are very deceptive and changeable, both as to direction and strength. A fog signal may be heard plainly and then lost entirely for a time; or it may come apparently from one direction one time and from another the next. The greatest caution is required to avoid trouble.

The general rule is that when the fog signal comes with the wind it can be heard better close to the water; when it comes against the wind it can be caught more accurately aloft. Therefore, in close quarters station your lookout accordingly.

The normal summer barometer is about 29.40, lake level.

The most important thing about a barometer is its variation and not its absolute reading. You may have a dead calm or a big blow around either 29.00 or 30.00. However, a low glass should be watched constantly, for it breeds more trouble than a high one.

After a fairly steady barometer if the glass jumps in a few hours to ten or more points (.10 of an inch) from a low figure, you can be pretty sure of a strong wind shortly, somewhere from the northern half; or, if it drops similarly from a high point, you may look for increasing wind soon, probably from the southeast.

Any sudden rise or fall of, say, ten points is a warning that should not be ignored by a yachtsman, although it does not always mean a dangerous blow immediately.

The impression is quite common that our heaviest blows come with a falling barometer—that is, as the storm center approaches. This is not correct. The most dangerous winds come oftener with a rapidly rising barometer, when the wind shifts suddenly to the north or northwest as the storm center passes by.

The glass gives no warning whatever of some severe wind storms, and in others it shows but little change.

A form of wind storm in the summer which is particularly dangerous because it comes from absolutely clear skies and is heralded, if at all, merely by a rising barometer, not always rapid, with no other indications of bad weather, is that which usually accompanies an area of high pressure; a so-called "cold wave," moving suddenly down from the north or northwest upon an area of stagnant air and high temperature. It often causes a hard blow from the N. or NW. that may last many hours.

A very striking example of this occurred on Saturday afternoon, July 16, 1910, during a Lipton Trophy race, when, from almost a dead calm the wind veered gently from SE. to N., increased to a reefing breeze in fifteen minutes, and in an hour had dismasted one yacht, capsized another, disabled several others and worked up a formidable sea for small boats.

The blow lasted until Monday afternoon, reaching its greatest strength of thirty-eight miles Sunday morning and

gradually diminishing Monday. The glass moved up very sluggishly, the range throughout the blow being only from 29.19 to 29.34, lake level.

Another treacherous form of windstorm sometimes follows a period of thunderstorm weather, when, after a complete clearoff, a white squall rushes out suddenly and without any warning from the thunderstorm area. Though usually brief and limited in extent, it may be of great energy and dangerous to small boats.

A remarkable squall of this kind, of unusual energy and duration, occurred on July 28, 1912, off Chicago, a few days before the Nutting cup races.

A procession of thunderstorms had passed from west to east just north of Chicago during the day, with light and variable airs and a steady glass around 29.13.

About 6 P. M. all the clouds disappeared and the wind fell flat for a short time. Then a brisk wind sprang up from the NNE. that rose quickly to about thirty miles and lasted an hour and a half, the barometer rising only .06.

At times in the summer, with a steady barometer anywhere from 29.20 to 29.50, lake level, with no storm center near enough to exert any influence, there will be spells of weather when the wind will be influenced solely by local radiation. This gives the well-known lake breeze by day and land breeze at night. The lake heats more slowly than the land, and, on the east shore particularly, which has much exposed sand that radiates heat rapidly, as the sun rises and the warm air ascends the cooler air off the lake begins to flow inward around 9 or 10 o'clock and continues until late in the afternoon, when the temperatures of the land and water

are more nearly equal, and the wind drops. After sundown the land cools more quickly than the water, and the cool air flows out from 8 or 9 o'clock until the early morning, when the temperatures are again more uniform and the wind falls again for a time. On cloudy days this is scarcely noticeable, because of the lessened radiation. The breezes are apt to be southwest and northeast on the west shore, and northwest and east on the east shore; and a knowledge and recognition of these conditions may be of much value to yachtsmen when cruising along shore. These conditions are naturally limited in extent, and a few miles outside there is apt to be light, variable and fluky winds. The breezes are usually much stronger, in clear weather, on the bays and inland lakes along the east shore than in the lake itself; and there is occasionally a twelve or fifteen mile wind inside, with scarcely a ripple outside, as many a yachtsman has discovered to his sorrow when he got through the channel.

Don't waste any time watching the clouds to the east of you in thunderstorm weather. They will never get any nearer. Watch the southwest and the northwest. However, when a thunderstorm has passed over, or near by you on either side, keep a sharp lookout for the "kick-back" (the cold air rushing out from the little storm center), for it will often send you down to your cabin for a few moments and may cause trouble if you are not prepared, as it gives little warning. It is more apt to come from either side of the storm cloud than immediately back of it.

After a general storm the wind normally swings by way of the west, or backs through the east to the north or northwest, blows itself out and then becomes variable. If, how-

ever, in summer it swings to the west and holds there, you are pretty safe in figuring that it won't blow very hard nor last very long, and that it will soon back to the southwest or south. In other words, a westerly blow in summer is very seldom as hard as a northwester or norther, and rarely lasts long.

A clear-off at night after a cloudy day and under stormy conditions does not indicate a permanent clear-off and cooler weather, but merely a short interval between one storm and another that is following closely, with warmer weather coming soon and the wind working to the southern half and increasing shortly.

When intending to cross the lake in a very small boat it is wise to call up the nearest weather bureau for information. They are always willing to give it, and they may have reports of a sudden change coming—such as a hard norther or a northwester—that your own glass would fail to warn you of in time.

In the United States storms travel in a general easterly direction, usually somewhat north or south of east, occasionally east, very rarely due north or south, and then only as a temporary deviation from their general easterly course.

The only exceptions to this rule are the tropical cyclones which originate in the tropics to the southeast of Cuba and make a right-hand curve, starting off about WNW. and finally taking an ENE. course into the ocean.

When one of these gets far enough west its influence is felt more or less in the gulf states and all along the Atlantic seaboard as it moves northwest toward Florida and curves eastward again about Hatteras.

WIND-BAROMETER INDICATIONS

WIND BAROMETER TABLES FOR THE GREAT LAKES

By PROF. E. B. GARRIOTT, Weather Bureau

Height of Barometer (Lake level)	Direction of Wind	Character of Weather and Wind Indicated
29.40 to 29.60 and steady	West	Fair, slight changes in temperature, gentle to fresh winds.
29.40 to 29.60, rising	West	Fair, cooler, fresh west to northwest winds.
29.40 to 29.60, falling	South	Warmer, increasing southerly winds.
29.60, or above, falling rapidly	East to south ...	Warmer, rain or snow within 36 hours, increasing east to southeast winds.
29.60, or above, rising rapidly	West to north ..	Cool and clear, quickly followed by warmer, variable winds.
29.60, or above, steady	Variable	No immediate change, but wind will go to south inside of 36 hours.
29.40, or below, falling slowly	South to east ...	Rain or snow, increasing easterly winds.
29.40, or below, falling rapidly	South to east ...	Rain or snow, high easterly winds, followed within 48 hours by clearing, cooler, west to northwest winds.
29.40, or below, rising slowly	South to west ...	Clearing, colder, fresh to brisk west to northwest winds.
29.20, or below, falling rapidly	South to east ...	Severe storm of wind and rain, and wind shifting to northwest within 36 hours.
29.20, or below, falling rapidly	East to north ...	Severe northeaster, with heavy rain or snow and winds backing to northwest.
29.20, or below, rising rapidly	Going to west ..	Clearing and cooler, probably cold wave in winter.

When the wind sets in from points between south and southeast and the barometer falls steadily, a storm is approaching from the west or northwest, and its center will

pass near or north of the observer within twelve to twenty-four hours, with wind shifting to the northwest by way of southwest and west.

When the wind sets in from points between east and northeast and the barometer falls steadily, a storm is approaching from the south or southwest, and its center will pass near or to the south or east of the observer within twelve or twenty-four hours, with wind shifting to northwest by way of north.

The rapidity of the storm's approach and its intensity will be indicated by the rate and the amount of the fall in the barometer.

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